

Photographic Manipulation.

70.1

THE

COLLODION PROCESS,

THOMAS H. HENNAH.

FOURTH EDITION.



LONDON :

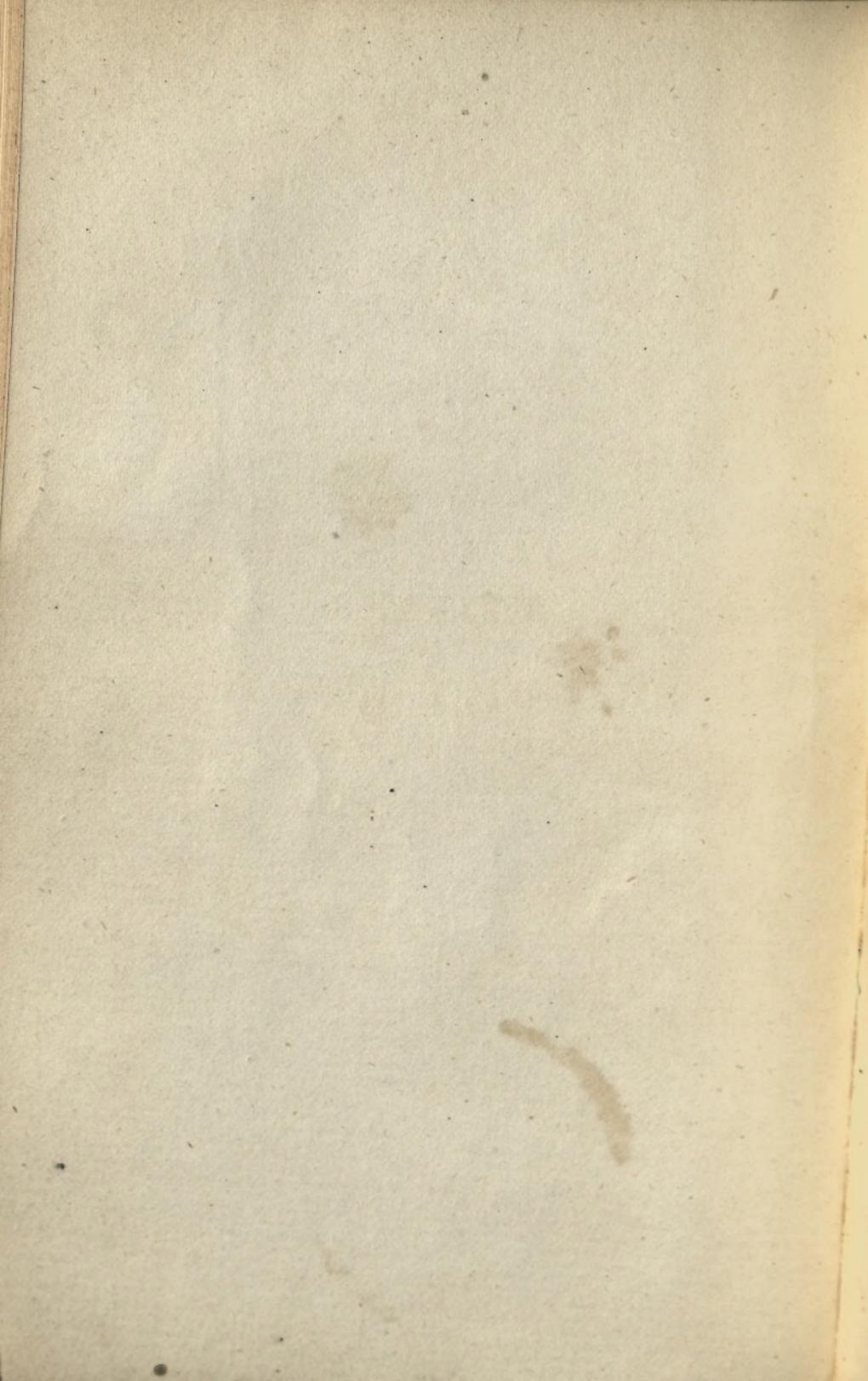
PUBLISHED BY GEORGE KNIGHT AND CO.,

Manufacturers of Photographic Apparatus,

FOSTER LANE, CHEAPSIDE.

1856.

Price One Shilling.



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220029 МОЛОДО

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PREFACE TO THE FOURTH EDITION.

After the lapse of but a few months the writer of the "Collodion Process" finds, notwithstanding its incompleteness and many faults, that another edition is required. The only alloy to the gratification he derives from so flattering a mark of approbation is, that the small amount of time he can spare will not allow of his making it, as it ought to and could be made, a *complete* manual of the process.

So many suggestions are daily made—most of them, however ingenious, practically useless, and all requiring careful examination before the good can be distinguished from the bad, that the task of selection alone is a long and difficult one, the more so, as in a work professing, as this does, to teach, it is necessary to exclude every thing that is at all doubtful.

Since the publication of the last Edition no improvements worth particular mention have been made in the process; indeed, considering the numbers engaged in the art, and the zeal with which most of them are actuated, its progress is remarkably slow and disappointing, when compared with its rapid strides at first.

The great impediment is the absence of a collodion of uniform character. This has not yet been found, nor from the writer's experience does he see much prospect of improvement, most makers occasionally, some frequently, produce it nearly perfect, but if a second quantity is applied for, it is almost certain to be different; not from want of care, but because no one yet understands all the conditions of uniformity.

All who have the time are earnestly recommended to give their attention to the perfecting of collodion, as the most likely means of rendering this beautiful art not only more popular, but also of extending the range of its usefulness far beyond anything it has yet reached.

If in the next Edition he can state that this bar to its progress is removed, not one of his readers will hail it with more pleasure than will

THOMAS H. HENNAH,

Brighton, December, 1855.

PREFACE TO THE THIRD EDITION.

IN offering a new edition of "the Collodion Process," the writer has to express his warmest thanks for the flattering manner in which the previous ones have been received, and at the same time to claim indulgence for the present, in which he fears that, notwithstanding all his efforts to bring it up to the time of publication, a few things may still be wanting.

He has to regret that some things stated in the last Edition were given without proper cautions attached, and so, instead of being beneficial, were hurtful; in others they were wrong. To the first of these proper explanations have now been added, and the last have been rejected altogether.

Much that is new, and it is trusted valuable, is added in the present Edition, and where anything is withheld it is in cases where so little certain is known that error instead of success might be the result of publication.

THOMAS H. HENNAH.

Brighton, April, 1855.

MORICK'S HOTEL AND BOARDING-HOUSE

and Worcester's Railroads. It is capable of holding
a sufficient number of passengers, and can be
run by horses, mules or steam power, and is
well fitted for carrying out all kinds of military and
all other kinds of travel. It is well situated, and
affords every comfort and convenience.

It is built of stone, and has a large and comfortable
room, with a large open yard, and a fine view of the river
Hobbs, and the surrounding country.

It is well supplied with all kinds of articles
of comfort, and is well fitted for the use of
travelers, and is well calculated to give a
comfortable and pleasant stay.

PREFACE TO THE SECOND EDITION.

THE object of the present little pamphlet is to lay before its readers, in a plain manner, the method of taking pictures by the collodion photographic process; and as to render it really useful in that respect, it is thought necessary to confine attention to one direct course, rather than to offer a pointless summary of all that has been published, no other choice is open than to give the result of personal experience. In doing so fear is entertained that prejudice may so far exert its influence as to cause much that is useful to be passed over; and, what is still more to be feared, much that is useless to have undue weight given to it; still for this the apology must be accepted, that for all that is wrong or wanting, the writer suffers as much as those whom he may mislead, nothing he practises being omitted, and nothing he has reason to condemn being mentioned.

With regard to the means of availing ourselves of the most valuable property possessed by the collodion *negatives* (their power of yielding an unlimited number of prints or proofs fac-similes of each other), a different course has been pursued, such that the writer knows to be good but difficult being omitted, to give place to methods more simple and easy, although it may be not quite so perfect in the end.

It would be ungrateful were the writer to omit offering his warmest thanks to the many kind friends to whom he has been indebted for his photographic knowledge and success, and for the royal road they have made for him by the readiness with which they have given him the benefit of their hard-won experience. When all have done so much it may seem invidious to mention any, still he cannot refrain from again thanking Mr. Berger and Mr. Eden for the many services they have done him, and of which he every day experiences the benefit.

That indulgence will be shown to what is necessarily imperfect, and that those who discover errors will, by pointing them out, enable him to avoid them in future,

Is the earnest hope of their obedient servant,

THOMAS H. HENNAH.

Brighton, July 4, 1854.

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THE
COLLODION PROCESS.

INTRODUCTORY REMARKS.

1. THE great and increasing interest so generally taken in Photography, particularly in the most recent and beautiful process of all, that by Collodion, has induced the author to give a few directions which, as the fruit of long experience, he trusts will enable those who desire to practise this valuable art, to obtain with certainty most beautiful pictures, capable of multiplication to an unlimited extent, and of surpassing delicacy and truth.

2. From the conviction he has for some time felt that most of the difficulties complained of by beginners are of their own making, and owing more to ignorance of the proper method of manipulation to be pursued than to any other cause, he is sanguine that if his directions are as faithfully followed as they are honestly given, they will be the means of helping many to a like success with his own; and while affording a means of useful and fascinating employment, will place at their command an art, the resources of which in aid of the artist, the antiquary, and the naturalist, are as inexhaustible as they are, comparatively speaking, unappreciated.

3. He would not be understood as claiming the merit of originating the whole course of manipulation here given as being most conducive to success; for, from the progressive nature of the subject, he has been obliged to avail himself largely of the labours of others who have bestowed much time and attention upon it; all that he has attempted has been to give in their plainest form, and in good faith, those methods

which a course of careful experiments and successful practice, pursued for some time past, has enabled him to point out as reducing the collodion process to a state of absolute certainty.*

4. Should any one be inclined, however, to find fault with the manner in which apparently trifling details are dwelt upon, he is reminded, that by following and applying the directions given, even those who are novices are almost sure of success, while those who neglect them as unnecessary throw discredit upon their pursuit and upon themselves by their failures.

5. The agent by means of which, from its extreme sensitiveness to light when properly charged with certain of the salts of silver, such beautiful pictures are to be obtained, has not been long known. It is a solution of gun-cotton in a mixture of ether and alcohol; and as all photographers ought to know how to prepare it for themselves, the following methods are subjoined. Before proceeding, however, the writer would premise that the opinions as to the different methods of iodizing, &c., are not hastily expressed, and that every formula has been put to the test of repeated and careful experiment; but still, owing to the uncertainty inseparable from all things with which time, temperature, or manual skill have much to do, it is possible that the same results may not follow the same course of proceeding with any two experimenters, indeed to so great an extent is this the case, that persons accustomed to the sight of photographs can generally distinguish the productions of particular operators by peculiarities of manner, which, considering the simple nature of the process, it seems scarcely possible should be manifested. Forbearance should, therefore, at all times be shown to those who attempt to teach, although it may be unsuccessfully.

* It is with regret that the writer feels compelled to qualify this statement; there are, however, occasionally instances of failure arising from remote causes, which perplex even experienced operators, and which, while rendering it more interesting, take it out of the domain formerly assigned to it.

PREPARATION OF THE SOLUBLE COTTON.

6. *First Formula.*—Powder, *coarsely*, 8 ounces of pure crystallized nitrate of potash, and after placing it in a basin or broad-mouthed stoppered bottle, add to it three quarters of an ounce (6 drams) of water, and pour upon it ten measured ounces of pure sulphuric acid, sp.g. 1·840, then, when it has been stirred with a glass rod, to ensure perfect mixture, immerse in it, without delay, by the same means, a quarter of an ounce of clean carded cotton, by small portions at a time, taking care that the whole is thoroughly and intimately mixed together. Immediately after which immerse the bottle or pan in a basin of hot water heated to 130° or 140° Fah., so as to keep up the temperature of the mixture. When it has remained at rest from ten to fifteen minutes, remove the cotton, by means of glass rods, into a large vessel of water, and by stirring briskly, and renewing the water repeatedly until it has no perceptible taste, wash out the whole of the acid and every thing soluble; then wring it in a cloth, and, after loosening it by pulling the flocks apart, dry it by hanging it up in a net where it can be exposed to a current of air, which will be found a much better method than by employing artificial heat.

7. The pure acid is recommended on account of its being easily procured of known strength. The object of the addition of water to the nitrate of potash is to reduce the strength of the acid, and at the same time to take advantage of the increase of temperature, which is always caused by the mixture of water with strong sulphuric acid.

8. If red bubbles or fumes of nitric oxide are disengaged in the mixture, as will sometimes be the case when the cotton has been pressed too closely together, it must immediately be stirred with a glass rod, which will generally put a stop to the action. The cotton is not so good when this gas is set free; we should be careful therefore to avoid it as much as possible by seeing

that each addition of cotton is well imbued before more is put in ; we should also carefully avoid using too much cotton.

9. If the first water is previously made as hot as the hand can bear, it will act much more thoroughly than if cold ; the sulphate of potash formed in the process being but slowly soluble in cold water.

10. The time taken in washing out the acid, &c. (particularly the first wash), influences greatly the solubility of the cotton, and its fitness for photographic use. If it is allowed to remain in either of the first two waters, or if it is dried slowly, it will, in all probability, produce an inferior collodion, and be unequally soluble, while, if the waters are quickly changed, and it is dried rapidly, it should dissolve in a mixture of five parts of ether sp. g. .720 (washed), and one of alcohol, sp. g. .8320 (60° over proof) with scarcely any residue ; and the collodion should be so tough as to allow of its being rolled off the glass without difficulty, that is to say, before the addition of the iodizing solution. If properly prepared, that is, if the nitrate of potash is pure, the acid of the proper strength, and both well mixed, and the temperature properly maintained, the cotton thoroughly imbued, and afterwards carefully and quickly washed and dried, the film produced by the evaporation of its solution in alcoholized ether should be perfectly equal and transparent in appearance, and quite free from marks, or crape-like lines, even when almost dry.

11. To the influence of imperfect and slow washing and drying, the writer believes, is due most of the difference observed between cotton prepared in large and in small quantities. An experimental portion is probably prepared in small quantity, the washing and drying rapidly and thoroughly performed, and the product is quite satisfactory ; but upon carrying out the process on a larger scale, this *thorough* operation is not so practicable, and the result is not so good.

12. *Second Formula.*—This, which is a modification of one kindly communicated to the writer by Mr. Williams, is, from

the nature of the materials employed, much more uniform in its product, and (particularly by the amateur) capable of being put in practice with more ease and less risk than the first.

13. Take of pure sulphuric acid, sp.g. 1·840, 6 measures; colourless nitric acid, sp.g. 1·440, 4 measures; fuming red nitric acid,* sp.g. 1·460, 2 measures; and of water, 1 measure. These are to be placed in a broad-mouthed stoppered bottle, and Swedish filtering paper is to be immersed in it, in the proportion of 12 grains to every measured quarter of an ounce of sulphuric acid in the mixture. It is to remain in the mixed acids twenty minutes, and is then to be quickly washed† and dried, as was recommended for the cotton.

14. If this is all carefully done as directed, and no waste is allowed, the paper, when dry, will be found to have increased in weight nearly 75 per cent., to have assumed the crispness and appearance of parchment, and, from being perfectly insoluble, to be as perfectly soluble in the mixture of alcohol and ether.

15. To prevent the paper matting together, and to facilitate the equal action of the acids upon it, it should, previous to immersion, be cut into strips about an inch broad, and then crimped across in this manner

16. Whichever of these methods is followed, the operation must be conducted either out of doors, or in some place where the acid fumes (which are copiously generated, and are exceedingly injurious if inhaled), can be immediately carried off. The hands, by coming into contact with the mixture, would be stained yellow; glass rods should always therefore be used in moving or stirring the cotton or paper. The smallest quantity falling on to any article of dress would produce a hole in a short time; and even the first two or three waters in which the cotton or paper is washed would stain, and in time destroy,

* Frequently called nitrous acid..

† In this case cold water will do.

anything upon which they may be splashed; on this account the whole should be thrown away as soon as it is done with.

17. In making choice of the cotton (or paper), the operator should have in view the particular purpose for which he requires it; that is to say, whether he wishes to keep it on the glass, or transfer the film to paper or wood after receiving the image. If it is to be transferred, cotton *perfectly soluble* should be used, from the facility with which it leaves the glass; but for beginners, or when it is to be kept on the glass, either cotton that is *not entirely soluble*, or paper that is soluble with difficulty, is the best. As far as the writer's experience goes, he believes that in most cases those collodions prepared from *imperfectly soluble* cotton (or paper) become attached to the glass with tenacity, while those in which a perfectly soluble cotton is employed are with more difficulty kept from working up from the glass. The last remark refers more particularly to *cotton* than *paper*; the difference is, however, only in degree. The amount of adhesiveness being materially influenced by the quantity of alcohol present; this may, however, be accepted as a general statement of the difference between soluble and partially soluble preparations.

PREPARATION OF COLLODION.

18. A mixture is to be made of 5 measures of washed ether, and 2 of alcohol, sp.g. .832, and to each measured ounce of the mixture from 3 to 6 grains of prepared cotton or paper are to be added, shaking the whole together at intervals until a solution is obtained, which, if the cotton is good, will be very quickly.

19. The ether and alcohol must be perfectly pure, and when procured should be kept in stoppered bottles, as from the readiness with which they dissolve oils and resinous bodies (both exceedingly hurtful), they are very likely in the course of manufacture and afterwards, to be rendered unfit for photographic use.

20. Ether that has been kept some time gives a better collodion than when newly prepared, although when iodized it sooner acquires colour from the liberation of iodine.

21. Alcohol of the strength named (sp. g. .832, or 60° over proof) can be easily procured, but when stronger there is more difficulty.

22. No exact proportion of cotton can be specified on account of the varying solubility of different samples, and also for the reason that a different amount of thickness or viscosity is produced by equal weights of almost every separate preparation.

23. A stock of this plain or uniodized collodion may be prepared sufficient to last three or four months, as it will by standing become clear, and be always ready for immediate use; much beyond this time it will (*if originally fit for photographic use*) not keep good, and those who are unfortunately tempted to lay in a large stock for use abroad, &c., will find themselves sorely disappointed when they attempt to use it. It becomes *short*, and wanting in continuity, producing a granular and poor film, incapable of receiving definition. The writer does not say this from limited experience, he having tried collodion from almost every house in London, which he has had by him for some time, and which in every instance, without exception, he found perfectly useless. He speaks thus plainly, to avoid the loss and disappointment which must be felt severely by those proceeding to a distance, relying upon its remaining uniform, and finding that, perhaps, after a long journey has been taken with a view to its use, the main object is frustrated by its failure, when no means are at hand to replace it.

24. By whichever means the collodion is prepared, it is to be iodized, or made useful in photography, by adding to it the following solution in the proportion of one dram (fluid) to seven of plain collodion:—

Alcohol sp. g. .832 1 fluid ounce,
Iodide of ammonium . . 30 grains.

These are to be mixed together in a stoppered bottle, and, by

shaking at intervals, a solution will be obtained, which should be filtered through bibulous paper, and, as an additional precaution against the entry of insoluble matters into the collodion, the bottle in which it is kept should not be disturbed for some time before any is removed for use ; in fact, this precaution is most necessary, both with regard to the iodizing solution and the collodion, if very rapid action is required, as it completely prevents the necessity of waiting, after iodizing, for the collodion to become clear previous to use, and so, by enabling us to avail ourselves of the extreme sensitiveness of newly iodized collodion by using it at once, affords us the opportunity of securing many portraits of children and representations of moving objects which could not in any other case be obtained.

25. The sensitiveness of collodion is found, in every instance, to diminish slowly but steadily from the time of its being mixed with the iodizing solution, but although pictures are produced rapidly in proportion to the newness of the collodion, the same perfection of finish and tone is not, with some kinds, so easily reached at first, as when a day or two is allowed to intervene.

26. The influence of this change on the character to the pictures produced is worthy of the closest observation ; and as to the novice in photography example may be better than precept, the writer will repeat from a former edition one of the instances which occurred to himself. He took on the same day, as nearly as possible at the same time, two pictures, to one of which he gave two seconds' exposure, to the other forty, and in both cases the results were equally good. Now, the only difference in the preparation of the glasses was, that for the first, collodion only three days old was used, while that used for the second had been mixed more than six weeks. It is necessary to add that both samples of collodion had been prepared in the same manner and from the same chemicals.

27. When the operator is without experience in the working of his collodion, he will save time, temper, and materials, if, in the first instance, he takes two pictures of the same object, giving

to the first, if the light is tolerably good, from one to four seconds' exposure, and to the other from thirty to forty. The difference of their appearance after, and while developing, will be the best guide to the time to be allowed in future trials.

28. Much error has arisen from this fact of the varying sensitiveness of collodion, and the great difference of result according to the length of exposure to light. To these causes the writer attributes the conflicting opinions expressed on the merits of different iodizing and bromizing solutions, and their power of rendering half tones perfectly, the fact being, that by giving a short and a long exposure to the very same collodion, either a perfect absence, or as complete a superabundance of half tone, is obtained in the photograph, and when a comparison has been instituted, in nine cases out of ten, the experimenter has either been led away by novelty, or the iodized collodion has not been quite fresh, while the bromized has, on the contrary, been perfectly so.

29. In this view of the matter the writer is confirmed by many comparative experiments, and from them he is led to believe that, although, perhaps on the score of rapidity of action, the balance slightly inclines to bromized, it still possesses so many defects, that it cannot bear comparison with iodized collodion, and that, for all cases of portraiture or general use, where uniformity of action is desirable, the formula he has given for iodizing is as perfect as any at present known.

30. The difficulty of obtaining good iodide of ammonium experienced formerly, is now no longer a reason for preferring the potassium salt, and although too unstable for the purpose of those who make large quantities of collodion for sale, it is much the more satisfactory to the practical photographer. Its general working is much more equal, and a finer finish can be obtained in the negative than by the means of other salts. Another reason for giving it the preference over the potassium salt is, that when its decomposition is brought about in the

bath, nitrate of ammonia results instead of nitrate of potassa. The reason for preferring the former of which will be mentioned when speaking of the bath.

31. The method proposed by Mr. Crookes for restoring the sensitiveness of old collodion and preserving that of new, by immersing in it a piece of silver foil, is as valuable as it is simple. Collodion becomes slow in action principally from the liberation of free iodine by the decomposition of the iodide of potassium contained in it. Metallic silver combines readily with free iodine when brought into contact with it, forming iodide of silver, which is soluble in a solution of iodide of potassium, and as the object of iodizing collodion is to enable us eventually to form an iodide of silver, it follows that, instead of anything being lost by the combination of the iodine with the silver, our work is in fact anticipated, and that in proportion to the quantity of iodine liberated, combined with silver, and again dissolved by the remaining iodide of potassium, so is the quantity of silver required from the bath to excite the plate diminished. It has lately been suggested that zinc might advantageously be substituted for silver, on account of the iodide of zinc, formed by the action of the iodine in the collodion upon it, being soluble in alcohol, instead of an iodide of silver, which is only soluble so long as there is sufficient unchanged iodide of potassium to dissolve it. Although in theory the foregoing holds good, it does not in practice appear to be of importance which is used, for with neither can old collodion be made to equal new, as is asserted, nor can the relative expense of the two methods be brought in question, the silver costing in the end no more than the zinc, all that is lost in the collodion being, as aforesaid, saved in the bath.

32. Unfortunately, however, these, like many other good remedies, go a little too far. It is necessary to the perfect working of collodion that a minute quantity of free iodine should be present in it, on account of its power of preventing fogging, or cloudiness, and in practice it will be found necessary to add

sufficient tincture of iodine to effect this; generally, for negatives, about a drop to the ounce of collodion will do, or if for positives two or three drops, but it must be remembered that it is only in case of the *complete removal* of the iodine (which may be known by its losing the usual yellow tint), that this addition must be made; at other times it will do more harm than good.

33. A remarkable and almost unaccountable difference is commonly observed in the degree of sensitiveness to light of different samples of collodion independently of the iodizing solution used, and it is believed that more remains to be done in the preparation of a *good collodion*, irrespective of sensitizing solutions than in any other branch of the process, for there is no doubt that most of the superiority of this over other methods is due to the little understood qualities of the collodion itself. When prepared apparently under the same circumstances, iodized in the same manner, and at the same time, in one instance so much as four times the exposure was required for one than for another; and what is also remarkable, the least sensitive has invariably been that which most slowly showed the colour due to the liberation of iodine. It was for this practical reason that the writer, on a former occasion, did not entirely concur in Mr. Crookes's observations, a proceeding which, he has learned, excited some surprise at the time, although since warranted by the experiments of others, leading to the conviction that too much stress has been laid upon the benefit to be derived from using collodion free from iodine, when rapidity of action is sought after. It is doubtless of consequence that much should not be present, but the writer believes that to some hitherto hidden cause must be attributed the rapid diminution of sensitiveness observed in collodion after its being first iodized. He has frequently added a large proportion of tincture of iodine to newly-mixed collodion without materially altering its action in any other way than in the production of clearer negatives. It must not, however, be forgotten,

when considering these statements, that the condition of the exciting bath may at one time render necessary an alteration in the collodion which at another might be hurtful.

34. It may be expected that something should be said as to the use of iodide and bromide of iron in collodion, but the writer has to confess to a complete failure in all his attempts at making a practical use of them; as, however, many whose names he respects much, have spoken in their favour, he can only attribute to his own carelessness or want of skill the difference of his results from theirs, and must leave to other hands the task of working out their theories.

35. Mr. Shadbolt has added to the list of thoroughly useful and practical suggestions, for which photographers are indebted to him, one for the use of chloroform in collodion for the purpose of making it more sensitive, and at the same time considerably enhancing its power of rendering half tone.

36. It is to be added in the proportion of twenty to thirty minims to each ounce of collodion. In the writer's experience, it has increased the rapidity of his collodion at least one-half, but, except in the case of having a collodion which gives hard and intense negatives, he thinks the above proportion too great, from ten to fifteen being sufficient, the larger dose lowering the intensity so much that the resulting proofs are wanting in vigour and brilliancy.

37. As collodion is the only requisite to the photographer, upon the preparation of which many observations will be made, the writer trusts that he will be excused for the space he has given it, and will proceed at once and more briefly to the consideration of what remains.

CHOICE AND PREPARATION OF THE GLASS.

38. Glass, known in commerce as "patent plate," should be chosen, free from scratches, perfectly even, and well polished, then after having cut it into squares, so as to fit easily into the camera frame, the edges should be roughly ground, in order

that the hands may be protected from injury, and that the adhesion of the film of collodion to the glass may be rendered more perfect than it would be without this precaution; indeed, with some samples of collodion prepared from cotton, it is almost impossible on unground glasses to keep the film perfect through all the washing it has to undergo, the water making its way underneath, disturbing it completely, and of course rendering useless all previous care and trouble (if such a work can be admitted by a photographer).

39. The necessary articles for cleaning the glasses are a few linen cloths (fine diaper is the best material, from its being more free from flue than other kinds), an old piece of cambric and a mixture of tripoli powder with alcohol, of the consistency of cream, to which may be added a small quantity of ammonia, and what may sometimes be found even better, a mixture of cyanide of potassium with tripoli powder, in the proportion of cyanide 1 dram, water 1 ounce, and sufficient tripoli to bring the mixture to the consistency of cream.

40. The cloths should be scrupulously cleansed from all impurities by boiling them in a solution of common kitchen soda, and then washing them several times in clean water, care being taken to avoid the contact of grease at all times. When thus prepared, they should be carefully kept from those used for wiping the frames, &c., and should not be used for any other purpose than those for which they are first appropriated. In fact, as it is upon perfect cleanliness that success so much depends, so it is impossible to carry attention to it too far, if we are desirous of overcoming quickly what might otherwise prove a difficult and tedious task.

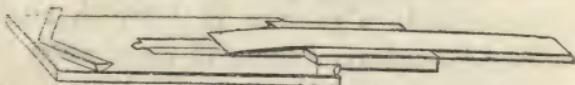
41. The best method of cleansing the glasses is the following:—Pour a small quantity of either of the above mixtures upon the glass, and with a tuft of cotton tied up into a ball, or a roll of soft linen rag, rub it well over both sides, then either hold it under a tap or rinse it in a basin of clean water, and before it has had time to dry spontaneously rub it well with

one of the prepared cloths until all moisture is removed, and finish with a perfectly dry cloth, in which it must be held all the time, so that the hands may not come in contact with it.

42. By breathing occasionally upon the glass, and holding it so that the light may strike it obliquely before the moisture of the breath has quite evaporated, you may readily ascertain if it is sufficiently clean; any streaks or stains can be thus at once perceived, and may be removed by breathing hard so as slightly to moisten the glass and again rubbing it with the dry cloth. When the marks of the breath disappear smoothly and evenly you may be sure that the glass is clean enough; all that is then necessary is, just before coating the plate, to remove, with the piece of cambric, any dust or flue which may be upon it.

43. For small glasses the foregoing method is easily put in practice, but for large ones some precautions must be taken to prevent their being broken by the rubbing they have to undergo.

Fig. 1.



44. The little piece of apparatus represented in fig. 1, the invention of the late Rev. T. Meylor, will be found most convenient as a means of avoiding such an accident. The plate is to be laid upon it, and while one end is held under the bevel at the broad end of the board, the sliding piece of wood is pressed in until the glass is held firmly; to ensure which, the slide is bevelled at the end, and is made to move with sufficient friction to prevent its slipping while the plate is being cleaned. When the operation is finished it is merely necessary to withdraw the sliding tongue, and the glass will be released. The glass may of course be washed and roughly dried before placing it on the polishing board.

45. Additional care is requisite when positives are being worked for, many trifling stains which would not be noticed in a negative being then made very visible. It is therefore better to give the preference to the cyanide mixture in this case, and after drying the glass, to finish with a little dry tripoli and a piece of linen or cambric quite free from grease.

46. After having taken a picture by the pyrogallic process, nothing but clean water is required for cleaning the glasses; but in every other case, notwithstanding what has been said to the contrary, no reliance can be placed upon cleaning with simple water, particularly when the glasses are new. If ammonia is used for cleaning it must not be in the same room in which the plates are rendered sensitive, for if present in the atmosphere and the bath is in a condition to work *well and rapidly*, it is almost sure to cause a blackening of the film when it is developed.

COATING THE PLATE.

47. This operation influencing so materially as it does, by the manner of its performance, the character of the finished picture, is so purely a matter of delicate manipulation, that although very easy in practice to those who have ever seen it done, is, like most things requiring manual skill, much more difficult to teach by precept than example, and although in the following directions the writer has endeavoured to render intelligible to the beginner the method he thinks the best, he would never, theless advise those who have the opportunity to get a little *vivâ voce* instruction from a friend as the best means of saving both time and collodion.

48. Hold the glass horizontally in the left hand by one of its corners, and pour the collodion on to the centre, using a quantity sufficiently great to spread easily over the whole surface, by giving to it a movement of rotation; that is to say, incline the plate, so that the collodion may flow gently

first to corner No. 1, then No. 2, then No. 3 (if possible avoiding the thumb), and then to No. 4. When the surface has been thus perfectly covered, return into the bottle from corner No. 4 all the superfluous collodion, raising the glass steadily, without haste, so

Fig. 2.

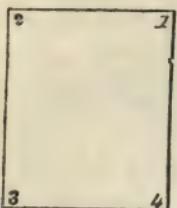
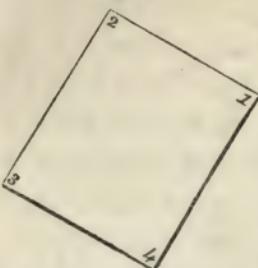


Fig. 3.



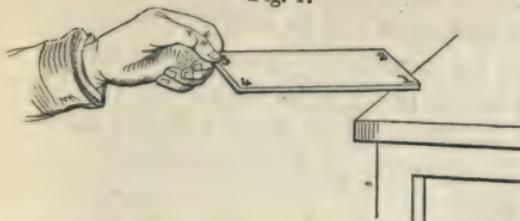
that it may be vertical, in a line drawn from 2 to 4, fig. 3; then by raising corner No. 4, cause the lines formed in the collodion by the draining to run into each other, and leave an even surface, after which, return the glass to a horizontal position for a few moments. The principal difficulty in the way of getting a perfectly even film is unnecessary hurry. If the glass is raised quickly to return the excess of collodion into the bottle, it is quite impossible with after care to make it even, and it will be found more economical to sacrifice the small quantity of ether lost by evaporation than to spoil a negative by allowing insufficient time. If a small bottle is used, say a 1 ounce, when plates 5 by 6 are being coated, the deterioration of the collodion by the loss of ether is practically not worth notice, as when it becomes half empty it can be again filled up until it becomes too thick to flow easily, when a small quantity of pure ether may be added to thin it.

49. Some very experienced operators prefer draining from the opposite corner to that held (No. 1), but there is then the chance of any dirt or impurity upon the finger being carried right across the plate, while by the foregoing method it is retained at the edge.

50. When the glasses are so large and heavy as to be difficult to manage without some support in addition to the fingers, they may be easily coated by resting corner No. 1 on the edge of a table or other convenient support in the manner represented in fig. 4.

51. All necessary alterations of position can be made
with ease without removing the corner from the table, and
it will be found that the directions given
above will apply
equally whether a

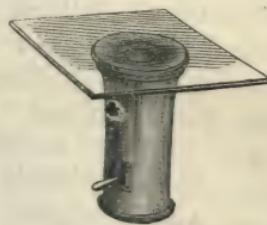
Fig. 4.



support is used or not.

52. There are also many different kinds of plate-holders recommended, of which that represented in the accompanying cut is by far the most efficacious.

The plate being laid on the top (A) which is edged and lined with caoutchouc, is secured by pushing the lever (B) into a catch placed lower down, and so causing a partial vacuum. It may be immediately detached by liberating the lever from the catch.



53. A frequent cause of failure is the presence of small pieces of dry collodion on the neck of the bottle; these should be carefully removed, for when suffered to remain they are carried by the collodion on to the plate, and there being partially dissolved cause large *striae*, which inevitably spoil the picture.

54. Another precaution necessary to be taken when a large quantity of collodion is mixed at a time is, to preserve it in a large bottle and decant into a smaller one, a short time before using it, the quantity required for coating only a small number of plates. By this means the presence of the deposit which sometimes forms at the bottom of the bottle is avoided, and with it the spots upon the picture which it causes. When, however, the care recommended when speaking of the preparation of collodion is taken, that both the iodizing solution and collodion are quite clear before mixing, advantage can be taken of the

extreme sensitiveness of newly iodized collodion, and sufficient only for present requirement need be mixed, there being little chance that this cause of spottiness will be met with.

55. The operator must not immerse the plate in the sensitive bath until the collodion begins to set or become firm. The time to be allowed for this varies, however, so much with the age and make of the collodion and the state of the atmosphere, that no rule can be given as infallible.

56. If the plate is kept too long before immersion, it will be unequally sensitive, those parts which were the most dry being least sensitive.

57. If the plate is immersed too soon, streaks and fringes, or, as photographers call them, curtains, will be observed proceeding from the edge of the plate at which the collodion was least dry. This is the most frequent error, and one more fatal to success than the opposite, but we must be careful in avoiding one mistake that we do not fall into another, but by observation learn the time suited to the collodion in use.

58. All the processes hitherto given may be performed by daylight; but in every subsequent operation, until the picture is fixed, the greatest care should be taken to exclude even the faintest ray of white light except that which acts upon the plate in the camera. The most practicable way of doing this is to cover the windows of the operating room with two or three folds of yellow glazed calico, light passing through a yellow medium having so little (if any) chemical effect that a large supply may be safely admitted, so much at least as to admit of all necessary operations being carried on with ease and comfort. It is a common error, and the cause of many failures and breakages, to suppose that our supply of even this light must be limited to barely enough to allow of our moving about.

59. Should the operator find it necessary to coat the plate by the light of a candle, he must be careful not to approach it too closely when doing so, the vapour of the ether contained in the

collodion being highly inflammable. This caution deserves attention, several instances of severe accidents happening from its neglect having come to the knowledge of the writer.

EXCITING THE PLATE.

60. For this the following solution is required, in quantity proportioned, of course, to the size of the plate and the capacity of the bath :—

Nitrate of silver	40 grains.
Iodide of silver	to saturation.
Alcohol	30 minims.
Distilled water	1 ounce.

61. These must not be mixed directly together, but the following mode of proceeding must be adopted, which, although for eighteen ounces of solution, can of course be altered by a little calculation to any required quantity, the same proportions being observed :—Dissolve an ounce and a half of nitrate of silver in three ounces of water, and when a solution is obtained, add four grains of iodide of potassium or ammonium previously dissolved in half an ounce of water. This will precipitate iodide of silver,* which will almost immediately dissolve. When the solution has become clear again, add fourteen ounces of water, which will cause it to become opaque from the re-precipitation of the iodide of silver which has been added in excess for the purpose of saturating the solution completely, but which must be removed by filtration through white filtering paper. When the solution has all passed clearly through the paper nine drams of alcohol are to be added.

62. When the alcohol and silver solution has been well mixed by shaking and then allowed to remain at rest for twelve hours, in all probability on exciting a plate with it good negatives will be produced; if such is not the case, it must be

* The small quantity of nitrate of potash or ammonia produced by this decomposition is of no importance.

tested with litmus paper, and if any sign of acidity is shown, ammonia must be poured in, drop by drop, until the acid is neutralized, and a slight alkaline re-action is manifested; * then glacial acetic acid is to be added by two drops at a time, until the plates develope *clearly*. It may, however, happen that, instead of an acid re-action, there may be an alkaline one (see note at foot of page), which will have to be remedied by adding acetic acid as before stated. This latter fault, although much less likely to occur, is much more likely to be perceived by the beginner than the former, for with this he *cannot* get a picture, but with that he can. Neither of them, however, often occur with a new bath, and the remedies, which would do more harm than good if not required, are proposed as remedies only, and not as necessary at all times.

63. The object of neutralizing any acid at first found in the bath is, to avoid the possibility of much nitric acid being present, the writer having frequently experienced its prejudicial effects on the production of negatives, while, on the contrary, acetic acid, when present even in larger quantities, is not so hurtful at all events; while ensuring *clean* negatives, it seems to diminish the sensitiveness of the plate but little, and for working out of doors, or in a strong light, is decidedly advantageous.

64. When, after neutralizing the free acid in the bath, the ammonia is added in *slight excess*, a minute quantity of oxide of silver is thrown down, and this, when acetic acid is added, unites with it, forming acetate of silver, to the presence of which, with free acetic acid in his sensitive bath, the writer formerly attached much value on account of its effectually preventing, by its own decomposition, the presence of even a trace

* An amount of alkalinity quite sufficient to blacken a plate on developing may be present without exerting any perceptible action on the test paper; it is better, therefore, to try plate by plate after every two drops, until the film, when developed, appears of a transparent reddish brown in cloudy patches, which is a sign that alkali is in excess.

of nitric acid, so long as any remained in the bottle ; and, although this opinion is now modified, he still thinks it may be beneficially employed, if not so indispensable as when he entertained a strong opinion against nitric acid even in minute quantity.

65. If the collodion is ordinarily good, negatives produced from a bath composed as above have great intensity, and the deposit forming the lights of the picture is completely in, instead of on, the film, and the negative will, if carefully used, yield many proofs, without being subject to injury, although unvarnished.

66. The addition of a small quantity of nitrate of ammonia is highly advantageous in keeping the surface of the bath and plates clean and free from stains, by its power of holding the oxide of silver in solution, as well as slightly accelerating the action of the bath ; but at the same time the bath must always have an acid reaction, or it will itself cause the plates to blacken, the alkalinity, so much talked of lately, being, in many cases (as pointed out by Mr. Hardwich), due to the solution of oxide of silver in that salt rather than to the presence of any of the alkalies simply soluble.

67. The fogginess so frequently complained of is, when not owing to light having reached the plate, often caused by the presence of bodies acting as alkalies, the remedy for which (after trying a stronger dose of acetic acid in the developing solution) is the addition of acid (acetic) to the bath, until the alkaline reaction is no longer recognized. The altered developing solution should however always be first tried; many failures of beginners arising from variation in the strength of the acetic acid sold in the shops, much of which is far from its proper strength, while most formulæ for developing solutions are framed on the supposition that really *glacial* acid is to be used. The fogginess is also, though not so often, caused by an excess of *nitric acid*, so diminishing the intensity of the negatives produced, that, in order to obtain any force, the development has to be carried on too long, that is, until a general reduction of silver takes place over the whole surface,

the consequence of which is, that the negative is generally very inferior in quality, and the resulting positives wanting in all freshness and vigour. In this case ammonia must be cautiously added, until the negatives are produced both clean and intense—a drop or two will in most cases suffice; if, however, too much is added, a general blackening will take place.

68. If a bath has been in use some time, and old collodion containing much free iodine been excited in it, a large accumulation of nitric acid, liberated by the union of the iodine with the silver of the bath, will be found in it. This it is which gives rise to the state mentioned in the preceding paragraph, and which must be remedied as there pointed out. Beginners must not be deterred, however, by this statement from using collodion that has been mixed some time, for it is by the use of it in a nearly neutral bath that the best negatives can be most easily obtained, subject only to less rapid action than when a more recent preparation is worked with, and the slight inconvenience of having occasionally to remove the acid produced.

69. The characteristic of negatives produced from a bath containing nitric acid in any quantity is, besides transparency and want of depth, the greenish tint of the deposit when viewed by transmitted light whilst wet.

70. Sometimes a very remarkable and almost contradictory change takes place suddenly in baths that have been simply prepared, that is, without the addition of either acid or ammonia. The image on developing (if the exposure has been of sufficient duration for the production of a good negative, supposing the bath to be in good order) presents the anomalous appearance of an image in some parts positive and in others negative by transmitted light. Those parts which have received most light, such as white drapery, the face, &c., being positive (the reverse of the usual effect), while the parts least illuminated present the ordinary or negative appearance. These effects are accompanied by the disagreeable circumstance that, if we give an exposure sufficiently short to prevent the change in the lighter parts, we cannot get drawing into the darker ones.

71. It will also be found, by giving considerable excess of exposure, that the whole will become positive, and the problem of obtaining direct a positive image in the camera will be solved. The writer has not yet succeeded in controlling this change so far as to bring it about at will, anxious as he has been to do so; he hopes, however, soon to be able to succeed. At present it remains an useless because an unexplained fact, but although unable to point out the cause, it is satisfactory to be able to point out the remedy, which is no other than repeating that for an acid bath, adding ammonia in the proportion of six drops to sixteen-ounce bath, and taking an experimental plate; if it blackens on developing, sufficient has been added; if not, we must add more cautiously until that result is obtained. Then add acetic acid, drop by drop, until the negatives develope clearly.

72. The most valuable feature observed when this change takes place is, that after the above correction the bath gives more perfect negatives than can be obtained either from a new one or from one which has been treated in the same manner, but which has not previously undergone the change in its properties. After correction we cannot again with any exposure bring about the previous effect of light and shade.

73. Nitrite of silver is a most valuable addition to the sensitive bath in the proportion of from ten to twenty minims of the saturated solution to each ounce of the bath.

74. The preparation used by the writer is not the pure nitrite; it is as follows:—Mix equal parts of nitrate of silver and nitrate of potash, and heat them gradually over a lamp in a porcelain crucible. The mixture will fuse as the temperature is raised; oxygen will be liberated, and the nitrate be converted into nitrite. For photographic purposes the heat must be raised and continued until bubbles of nitric oxide are liberated in small quantity, and a small quantity of silver reduced to the metallic state;* when cold the mass is to be dissolved in as

* Giving rise, it is conjectured, to the formation of hyponitrate of silver, which, from the photographic effects of hyponitric acid, may be the active agent in producing the change attributed to the nitrite.

small a quantity as possible of distilled water, and the solution filtered for use.

75. The resulting negatives are very perfect in tone with an amount of exposure, which without it could scarcely be half enough. It, however, entails the necessity in some cases of using rather more acetic acid than usual in developing, to prevent its tendency to produce cloudiness.

76. A general tone of reddish brown pervading and *confusing* both lights and shadows betokens an alkaline bath; but if the alkalinity is only so slight as to be corrected by using more acid in the developing solution, much more beautiful negatives can be obtained than with an acid one.

77. The bath, or rather the vessel for containing it, is best made of gutta percha or porcelain (glass, on account of its transparency, is objectionable), and should be of sufficient width to allow of a large quantity of solution being used; the false economy of using narrow baths being one of the most frequent causes of that inequality and cloudines observed in collodion photographs. For a plate 5 inches by 6 the bath should have at least the following dimensions:— $7\frac{1}{2}$ inches deep, $5\frac{3}{4}$ wide, and $1\frac{1}{2}$ across, and although a larger one is not actually required, still the larger (in moderation) that it is, the more will the equality and smoothness of the picture be promoted.

Fig. 5.



78. The dipper (of which, with the bath, a cut is appended, fig. 5,) should be made of plate glass, a small slip of that material being cemented across the bottom to prevent the plate from falling off. This piece of apparatus should be selected with care, its greatest value arising from the fact, that its smooth plane surface when wetted enables us to bring the power of capillary attraction to our assistance for attaching the plate to it. This will not be the case if an uneven piece of glass is chosen.

79. About double the quantity of solution necessary for filling

the bath should be made, so that by pouring it back into the bottle, after use, it may be able to deposit any particles of collodion, dirt, &c., that may have got into it, and allow of a sufficient quantity being decanted off clear when wanted ; this will be found in the end more economical than making barely sufficient to fill the bath, the loss by filtering (which would in that case be unavoidable) not being necessary ; it is also of advantage, on the score of uniformity of action, as from its quantity it is not so liable to change as the smaller would be.

80. If the bath has a capacity of 16 ounces, 32 should be made ; and if to this a supplementary bottle of solution is added, from which the loss by waste can be supplied, the operator may rely upon uniformity of action for months together. It will be found, that by keeping the larger bottle full (filling it from the smaller), that no addition of silver need be made to keep up the strength of the bath, the loss by conversion into iodide corresponding nearly with the quantity contained in the solution required for filling up.

81. After returning the solution into the bottle the bath should each time be well rinsed with water by half filling it, and then holding the dipper across its mouth so as to close it, shaking it well, repeating the operation two or three times.

82. Sometimes a more thorough cleaning is required, in which case a solution of cyanide of potassium will do it effectually, rinsing it of course afterwards with clean water.

83. It may be as well here to mention, that when the temperature of the operating room is below 60° Fah., the action of the bath is much improved by placing the bottle containing it before a fire, or into a basin of warm water, before using it; this remark applies equally to all the solutions, and to ensure *perfect working*, not only should the solutions be equally heated, but the temperature of the camera as well should be at the same degree, so that the temperature of the plate from first to last may not vary to any great extent.

84. When the collodion, as before mentioned, has slightly set,

the coated glass is to be rested on the dipper, and immersed steadily without any pause, every check given to the movement producing lines which appear painfully distinct on every proof that it yields. The dipper, before placing the glass upon it, should be plunged into the bath for a moment to moisten it, for the reason before pointed out.

85. The proper time for the plate to remain in the bath cannot be stated with precision ; it is necessary, as practised by most operators, to allow it to remain undisturbed for about a minute, it may then with advantage be lifted out from time to time to ascertain the state of the film. *When the oily-veined appearance, caused by the ether, gives place to a surface over which the solution flows freely and evenly,* the plate is ready for the camera. No harm is likely to be done by allowing an excess of time in this part of the process as the film is not injured by prolonged immersion when the bath has been prepared with the iodide as before recommended.

86. When the plate is removed from the bath, all excess of liquid should be drained from it, and after doing so it is advisable to wipe the uncoated side of the glass with a piece of clean linen rag, and also to place small pieces of bibulous paper at the corners of the plate frame before inserting the glass, for the purpose of absorbing any liquid that may still drain from it. When thus treated, the plates are much less likely to stain, and the camera can be kept drier and cleaner.

87. When silver corners are added to the frames the blotting paper need not be used, unless indeed we are anxious to keep the camera clean, in which case a piece may be laid along the lower edge of the plate after placing it.

88. In concluding this part of our subject, the reasons for the use of iodide of silver and alcohol in the bath may be given.

89. The iodide of silver is added for the purpose of saturating the bath with that substance, and, by doing so, preventing its attacking and partially re dissolving the coating of the iodide formed on the plate, and so rendering the deposit unequal. If,

however, the plate is kept so long out of the bath as to allow of the solution remaining on it being concentrated by evaporation, it will again acquire the power of dissolving the iodide, and if allowed to get entirely dry, the whole will disappear; we see, therefore, that the protection is only for the time the plate remains in the bath, and does not extend beyond, and that the sooner we use it after it is excited the greater is the probability of its working well.

90. The alcohol is added for the double purpose of making the plate more sensitive (which it does to a considerable extent), and of rendering the action of the bath quicker and more equal. The objection to its use is, that from the different amount of volatility of water and alcohol, the composition of the bath must be constantly subject to variation. The advantages to be derived from its use are, however, so great, that its want of steadiness must be disregarded, and by supplying the waste, by occasionally adding a little fresh, as much as possible remedied.

91. A practicable mode of keeping collodion in a sensitive state for a length of time has been long looked forward to as one of the greatest improvements to which the process is open. For this we are indebted to Mr. Shadbolt; and as his own description is so very clear it is subjoined *verbatim et literatim* :—

92. “ Having prepared and excited the collodion in the usual manner, on its removal from the bath of nitrate of silver, it is to be drained pretty closely for about half a minute, and then immersed in a second bath, consisting of distilled water 20 to 30 ozs. to 1 oz. of the exciting bath (the exact quantity is not of great moment), and allowed to remain in the latter mixture until the liquid flows evenly on lifting the plate up, which will happen in about from two to three minutes after immersion. The object of this proceeding is to wash away all but a slight trace of free nitrate of silver, as one of the causes of deterioration of the plate is the crystallization of this salt on the surface of the collodion. This distilled water bath should be in a

vertical vessel similar to that used for exciting, and the same bath, if freed from impurities as they accumulate, will do for an indefinite time. To distinguish it, I shall term it the *washing bath*.

93. "The plate may be removed from this bath as soon as the liquid flows freely, and again drained closely, when a portion of the preservative syrup is to be poured on and off once or twice, being careful to avoid bubbles, or any minute particles of matter being left on the plate, which is then to be stood upright upon *clean* blotting-paper with the collodion side towards the wall, to drain. In about ten minutes' time, the lower edge of the plate where the syrup has become collected, may be touched lightly with fresh blotting-paper to remove the superfluity, and then placed in the dark frame, or stored away in a box for future use. It is not necessary to perform *this* operation until convenient.

94. "The preservative syrup is thus made:—Take of *pure honey* and *distilled water* equal parts by measure, mix thoroughly and filter. In my former directions a sixth part of the volume of alcohol was included, but further experience leads me to consider this unnecessary, if not detrimental.

95. "If thoroughly excluded from the action of light, plates thus prepared will keep good for a *very long time*. I have now two small stereoscopic negatives on plates that were excited on the 30th *November last* and not exposed in the camera until the 28th *December*, a space of exactly four weeks. They were not developed until twelve hours after exposure, which part of the process is conducted as follows:—The plate is to be again immersed in the washing bath and left from one to ten minutes to soak, occasionally lifting it up and down to facilitate the removal of the superfluous syrup and thoroughly to soften what remains upon the plate. The longer the latter has been kept, the longer it should be allowed to soak.

96. "When taken out, a sufficient quantity of the developing solution is to be poured over the plate in the ordinary way, and,

provided the plate has been properly soaked in the washing bath, there is no greater difficulty experienced in getting it to flow over, than when a fresh plate is used. The image should appear very slowly, and when all the details are out, *but very faint;* the developing solution is to be returned into the measure (*taking especial care not to allow the small portion remaining on the plate to run in lines*), a feat readily performed if done quickly, and the plate instantly restored to a horizontal position. A small quantity of the *exciting bath* (a 30 grs. solution of nitrate of silver), from an eighth to a sixth of the volume of the solution that was poured from the plate into the measure, together with a like proportion of the preservative syrup, should now be added to the liquid in the measure and well mixed up; this is to be poured on the plate and kept moving until the picture is sufficiently intense, which can be carried to any degree if the exposure has been proportionably prolonged. So intense *can* the high lights be made that a whole day's exposure to *direct sunshine* will not print through them. Of course I only mention this to show what can be effected—not what is desirable.

97. "When sufficiently developed, the picture is washed and fixed as usual, either with hyposulphite of soda or cyanide of potassium as may be preferred.

98. "The developing solution I usually adopt consists of 1 grain to the ounce of water solution of pyrogallic acid, one-fourth of the menstruum being the ordinary acetic acid of the druggists, or, if *glacial* acetic acid is used, one-twelfth part is sufficient."

99. Dr. Mansell's remarks on this process are most valuable, and constitute an addition to it which will extend its application much beyond what Mr. Shadbolt originally anticipated; at all events, Dr. Mansell has, by his improved treatment of the plates before developing, rendered their keeping over extended periods a matter of much greater certainty than before. His remarks are in themselves a pointed instance of the bearing of slight differences of manipulation upon the success of any process which, like all photographic ones, is dependent upon a nice adjustment of a number of trifling and sometimes opposing

influences. All that Dr. Mansell recommends as an improvement on Mr. Shadbolt's plan is to steam the plates before developing; his remarks, however, which are coupled with these recommendations are so good that no apology is offered for adding them at length.

100. "The plates were iodized as usual, immersed in a one-grain nitrate of silver bath for a few seconds, drained, and coated with two doses of syrup. It is much better to be a little prodigal of syrup and make sure work with it, for if it is repeatedly used there is great risk in long excited plates of the reduction of some of the nitrate of silver it contains and consequent speckling of the negative. I (Dr. Mansell) got perfect negatives with plates kept up to 198 hours, but, taking the average of eight experiments, I should say 150 hours is about the limit, after which there is more or less uncertainty. Beyond this time, owing to the hardening of the syrup and its almost total insolubility in the one-grain bath, the negatives were very defective, the image being extremely faint and obscured by a veil of indurated syrup, and the plate mottled over with black patches.

101. "The syrup, after it has been on the plate a short time, consists of two layers, an outer one which remains soft and hygrometric a long time and is soluble in cold water, and an inner film next the collodion, a compound of syrup and nitrate of silver which is insoluble in cold water. This is easily proved by washing the plate in a vertical glass bath, when this layer is seen separating in bran-like scales, the water mechanically removing it. This inner layer, after about 150 hours, becomes adherent to the collodion at first round the margin of the plate, then to the whole surface, covering it as with a varnish, which no amount of washing in cold water will remove.

102. "Seeing, however, that plates kept long beyond the above periods were still sensitive, yielding images, although extremely imperfect, I felt satisfied that, could the indurated syrup be removed, perfect negatives might still be obtained. It occurred to me that steaming the plate would probably dissolve

this indurated syrup, and after a few trials I met with perfect success.

103. "The following is the method I have pursued with plates which had been excited upwards of ten days before exposing in the camera (some having been kept 271 hours), although I am satisfied that the limit to the keeping of plates with this manipulation extends much beyond this period.

104. "On removing the plate from the dark slide, immerse it in the one-grain bath for five minutes, to remove the outer syrup, drain it, then hold it, collodion downwards, over the steam of boiling water poured into a flat pan for about ten minutes, taking care to keep the plate four or five inches from the surface of the water, the indurated syrup will gradually be seen to dissolve, and by inclining the plate the greater part is easily run off to any angle you choose. Having drained the plate, pour on pyrogallic acid (no image appears under this), after a minute or two, when the collodion has been well impregnated, pour off the pyro into a glass containing twenty-five minimis of a ten-grain nitrate of silver solution (for an $8\frac{1}{2}$ by $6\frac{1}{2}$ plate), and immediately pour it over the plate, the image rapidly comes out and may be developed as usual to any extent. With some kinds of collodion, or in very cold weather, it may be advisable before using the pyro, either to pour over the plate a weak solution of nitrate of silver, or to mix the nitrate of silver with the pyro in the first instance. I merely suggest this, having as yet found the method I have given quite sufficient.

105. "Steaming the plates cleans them so perfectly and gives such mastery over this method, that it is always better they should be so treated whenever there is the least fear that the syrup is indurated."

106. In this and the following operation it is scarcely possible to avoid staining the hands with the silver solutions. These stains may (if recent) be removed by first washing them over with a saturated solution of iodide of potassium, and then with nitric acid diluted, so as not to stain the hands yellow, that is to say, with twice its quantity of water. The iodide does not itself

immediately remove the stains, but upon applying the nitric acid they soon disappear.

107. A more expeditious and effectual way is to rub the stains with a lump of cyanide of potassium wetted with water, and as soon as they begin to disappear apply tincture of iodine to them, which will remove them at once, then wash the hands well to remove the cyanide. Care must be taken when using this salt on account of its extremely poisonous nature, and the injurious effects which follow upon its application to any part of the body from which the skin is removed. It must never be used if the hands are scratched or chapped, for in that case it will make its way into the flesh, a troublesome sore will be produced, and the loss of a nail may follow.

EXPOSURE OF THE PLATE.

108. The plate after being rendered sensitive by the last operation is to be submitted to the action of light in the camera with as little delay as possible. The time of exposure necessary for obtaining perfect results varies so constantly with the intensity of light, the power of the lens, and the state of the collodion and the bath, that no rule applicable to all cases can be given; the operator must therefore now depend upon experience as his guide, for *it is only by the behaviour of the film under the action of the developing solution, and the character of the picture after developing*, that he can judge if the exposure has been of the proper duration, and he should as soon as possible make himself acquainted with the appearance of the film both when over and under exposed, so as to be able at once to correct any error he may have been guilty of.

109. When a beginner, if a photographer wishes to produce photographs worthy of being called *pictures*, he should lose no opportunity of learning the causes of the variation in tone and finish observed in the work of different operators, and by finding out the sources of error as well as the means of success, enable himself to produce at will pictures of any character.

110. Difficult as this may at first sight appear, it is not so in

reality, and no one should be satisfied until he can command the photographic part of his art. When he can, although he may take a higher position than is deserved by those who have to trust to chance for a picture, he has still much to do before he will gain the name of artist as well as photographer.

111. It is not sufficient to place an object opposite a camera, and regardless of any thing but fine focussing to receive, and, alas! perhaps perpetuate what may be an enormity. Close attention must be paid—whether we are taking a portrait, or view, or copying a work of art—to the selection of a good point of sight, arrangement of light, &c.; and instead of denying or concealing the fact of the distortion of all images of objects in relief when thrown by lenses upon a flat surface, we should always bear it in mind, and by employing lenses of long foci and moderate apertures, and by arranging our subject so as to be as much in one plane as possible, reduce the error to its lowest amount, in fact until it is practically scarcely to be called an error.

112. All this may be and is done by many photographers, and when to this is added an artist's skill in making the most of a subject by arrangement of light and accessories, and choosing the point of sight well, they may surely claim for themselves a better consideration than that to which the mechanical attempts and sorry productions of self-styled photographers had nearly consigned them.

DEVELOPING THE PICTURE.

113. For certainty and uniformity of action nothing has yet been found so generally applicable to this purpose as pyrogallic acid when properly used.

114. The developing solution for ordinary use should be made as follows:—

Pyrogallic acid	1 grain.
Glacial acetic acid	5 minims.
Alcohol	10 minims.
Distilled water	1 ounce.

Mix, and filter through bibulous paper.

115. This solution will, if kept long, acquire a brown colour, particularly if in a hot place; it will, however, even in summer, remain good for a week, or if made with distilled water that has been recently boiled and kept in a stoppered bottle, it will remain fit for use two or three weeks. A slight degree of colour need not be regarded, still it is better not to mix too much at a time on account of its being undoubtedly rather better if used fresh.

116. The plate, having been removed into the operating room (from which all white light must be excluded) in the camera frame, is to be placed quickly and carefully upon the levelling stand (fig 6). A very convenient form of stand is also shown at fig. 7. A B is a cross formed of two flat pieces of brass, supported underneath by the brass rod (c), having a ring at d, in the upper part of which is a centre point by which it is supported on the brass arch (g), and kept in a horizontal position by the lead weight (e) attached to the lower end of the rod (c). F is a flat tray of gutta percha of sufficient size to catch any fluid that may run off the plate. The tray (F) may be supported on the ring of a retort stand, on a tripod stand, or a circular hole made in the table so as to allow the weight (e) to pass through. Being then placed on one of these stands, a quantity* of the preceding solution having been measured into a clean glass, a solution of nitrate of silver (forty grains to the ounce of water) is to be added in the proportion of two drops to each dram. When these have been mixed by stirring with a clean glass rod, they are to be poured

Fig. 6.

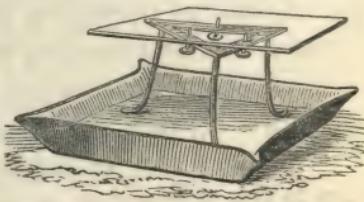
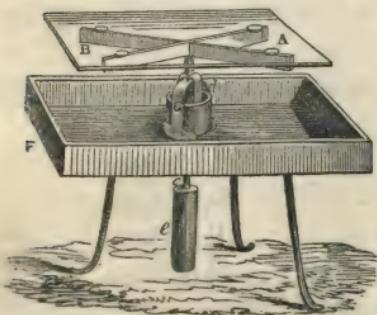


Fig. 7.



* More or less according to the size of the plate.

or almost thrown over the plate, taking care not to disturb the film by moving the hand, holding the measure in a circular manner so as to disperse the contents rapidly and evenly over the surface, which dispersion may be assisted by blowing upon the glass with the mouth ; this not only has the effect of rendering the application equal, but serves to keep in suspension the deposit which generally forms, and which if allowed to settle in any one place would spot the picture. The operator should not blow too long in one place, nor with sufficient force to remove the fluid entirely from any part of the plate—cloudy dirty marks being often produced by so doing ; another cause of unequal development is neglecting to mix the pyrogallic and silver solutions together with adequate care.

117. It will be observed that the preceding solution is spoken of as that for ordinary use, and for ordinary and almost universal use it is certainly the best the writer has tried. It may however happen, particularly when a new bath is in use, that it will not give intensity enough even when the collodion and other solutions are in good order. We must then (without exceeding three grains to the ounce) increase the quantity of pyrogallic acid by half a grain at a time until sufficient intensity is gained, at the same time adding a larger quantity of the silver solution.

118. If the wished-for intensity is not procured by the additional strength of the solution, some cause over which it has no influence must be at work, and must be sought for either in the bath, the collodion, or the *time of exposure*.

119. It frequently happens that, instead of a want, there is an excess of intensity ; in this case the first step should be to reduce the quantity of, or even entirely omit, the silver solution. If this does not do, the strength of the pyrogallic solution must be diminished ; but if neither of these remedies avail, longer exposure must be given. This last certainly prevents excessive intensity and hardness, and is perhaps more needed by the beginner than any other ; the common error of allowing too

short an exposure, giving rise to the condemnation of many really good collodions, and creating more disappointment than is generally supposed.

120. As soon as the fluid is applied to the glass, the operator should watch the progress of development with the utmost attention, for as before said it is upon a knowledge of the appearance presented by the film of collodion both when under and over exposed, that the beginner will have to depend for ascertaining the time for allowing the plate to be acted on by light.

121. He must from time to time, by holding a piece of white paper beneath the glass, and if practicable, by looking up through it, observe the amount of intensity he has obtained, taking the following remarks for his guide (until he has had experience) as to the time for arresting the action of the developing fluid.

122. If, upon pouring on the solution, the image appears tardily, and the high lights upon the portrait, &c., attain great intensity before the details of the dress are visible, and if after removing the iodide by the hyposulphite it exhibits a greyish appearance by reflected, and a perfectly opaque deposit in the high lights by transmitted light, *it has been under-exposed.*

123. If, on the contrary, the picture appears quickly, the shadows coming out nearly at the same time with the lighter part, and if after a time it begins to change all over, and, lastly, if upon removing the iodide no picture is visible by reflected, and only a faint one by transmitted light, *it has been over-exposed.* The great want of contrast in over-exposed pictures is worthy of remark, the folds of black and white drapery being even in the same picture scarcely distinguishable by their intensity from each other. It is commonly the case, when a weak solution of pyrogallie acid is used in developing, and the picture is over-exposed, that a beautifully ruby-red colour will be observed on looking through it while wet, and it will be found that, although it appears but of slight intensity, it will yield very perfect positives, the red colour becoming when dry a rich transparent

brown, and by so changing admitting of greater delicacy of tone and definition than when the same amount of intensity is obtained from a more opaque deposit. On this account it is of more advantage to over than to under-expose, still, from these very terms of *over* and *under*, it will be inferred that there must be some intermediate time of exposure more advantageous than that which would produce either of the results just described.

124. If upon developing, first the lights and immediately afterwards the shadows of the face, followed by the dress of the sitter, make their appearance, the deep shadows under the arms, &c., preserving nearly their original clearness, while the lights go on increasing in power, and after using the hyposulphite * it exhibits a coloured bloom of red and green upon its surface, the principal lines being clearly seen when it is looked down upon, and when looked through all the different parts of the picture are shown in their proper (reversed) gradation of power, a small amount of transparency remaining even in the highest lights, *it has had the right exposure*. Although the characteristics of a properly exposed negative are those given above, a considerable range of time may be allowed without producing an utterly useless picture ; but the beginner must remember that it is always better to give too much than too little time.

125. At the risk of repetition, a few useful hints on this subject may be given in conclusion.

126. If a plate has not been much under-exposed, a tolerable picture may often be obtained if the developing fluid is not allowed to remain on long enough to render the lights perfectly opaque.

127. An under-exposed picture is also frequently made useful by varnishing, its intensity being diminished by so doing, while, on the contrary, we should avoid varnishing a weak over-exposed picture for the same reason.

128. If a plate has been over-exposed, it is of very little use

* This is more particularly the case when nitrite of silver is used in the bath.

trying to increase the intensity of the picture by continuing the action of the developing fluid long after it has begun to blacken equally.

129. When properly exposed, the action may be continued until the whole of the details are clearly seen by transmitted light, taking care that the lights do not gain too much strength.

130. The operator must not confound the effects of over-exposure with those following upon the action of light upon the film, either from the frame not being well made, or from the room not being sufficiently darkened. They are very difficult to distinguish; in fact, so much so, that experiment is needed by most operators to ascertain to which they may attribute their failure. If the frame fits badly, the cloudiness will generally be partial, while if white light gains an entrance into the room it will be more equal, and will resemble more closely the effect of over-exposure. Light striking into the lens will also produce an appearance resembling over-exposure.

131. In most cases when over-exposed, the whole of the picture appears very quickly, and we see at first that it is the image itself which is developing *altogether* so fast; while if the cloudiness and weakness are owing to the action of extraneous light, the image will appear at first slowly, and then it will seem as if a general deposit took place over the whole surface, veiling the picture completely.

132. The beginner will also find difficulty in distinguishing the effect of an *alkaline bath* from that of over-exposure and from that just mentioned. But, as in the portion relating to the bath, he is cautioned against its use, and recommended to have it at all times slightly acid, time need not be wasted in describing what ought never to be met with.

133. When the development has proceeded far enough, the plate is to be removed from the stand and washed, by pouring a gentle stream of water upon its surface while it is held horizontally. This operation requires care; for if the water is poured from too great a height, or if the plate is too much inclined, the

collodion will be torn from it; but if *common care* is exercised, this accident is not likely to happen.

FIXING THE IMAGE.

134. After washing, the plate is to be immersed in a solution made as follows :—

Hyposulphite of soda . . .	10 ounces.
Water	20 ,,

Sufficient of this solution is to be placed in a gutta-percha bath similar to that used in exciting; and after resting the plate on a dipper, it is to be plunged in, and allowed to remain until the whole of the iodide is dissolved.

135. The plate may be examined occasionally by lifting it out of the bath, and when it appears quite clean and free from veined markings, it is again to be thoroughly washed to remove every trace of the hyposulphite from it; for if from this being carelessly done any should remain, it will after a time crystallize and destroy the film.

136. It may here be observed that the above solution of hyposulphite will serve for many plates, and must only be renewed when it becomes so saturated with iodide as to require too long a time to complete its action.

137. This application renders the plate insensitive to the action of light, and quickly dissolves the yellow iodide; while doing so the negative picture seems gradually to vanish, and then, if it has been well developed, to reappear as a positive. It is important that the action of the hyposulphite should be continued long enough to dissolve out the whole of the iodide, for if not completely removed at first, it will cause an otherwise good negative to be perfectly useless, the collodion seldom being able to bear a second application of the hyposulphite after it has once dried.

138. The picture, after being drained and then dried by holding it at a short distance from a fire or by placing it in a

draught of air, is finished, and may be printed from immediately ; it is better, however, when the negative is of sufficient intensity to varnish it previously as a protection from injury.

139. In the event of the operator not being able to procure a supply of pyrogallic acid, he will find the protosulphate of iron a very useful substitute ; it is, however, more difficult to obtain good pictures with it : the best method of using it is that proposed by Le Gray.

Protosulphate of iron	500 grains.
Sulphuric acid	20 drops.
Acetic acid	100 minimis.
Distilled water	10 ounces.

140. It should be placed in a glass or gutta-percha bath, and may be used for many negatives in succession until its reducing power is so far exhausted that it fails in developing the latent image. The muddy appearance it assumes may be disregarded, no ill effects resulting from it. The plate must be placed on a dipper as in exciting, and must be plunged quickly into the solution. In this there is no difficulty ; but in watching the development, much care is required ; for if the plate is kept too long out of the bath it will be covered with veined marking, which cannot be got rid of afterwards : it should be lifted out but for an instant, and if it is thought to be sufficiently developed, is to be immediately washed, either by immersion or by a stream of water. If, however, the image is not sufficiently brought out, it must be replaced in the bath until the desired intensity is obtained.

141. Some operators, to increase the intensity of the negatives produced by using the solution of protosulphate of iron, pour over the plate a weak solution of nitrate of silver. This the writer has not tried ; he cannot therefore state the necessary strength for the silver solution. In either case, after washing, the negative is to be fixed in the same manner as when pyrogallic is used, the protosulphate of iron recommended by Le Gray for fixing being most uncertain in its action.

142. It must be borne in mind that the iron solution is useful as a substitute, and as a substitute only, for the pyrogallic solution, except when instantaneous pictures are attempted ; it may then perhaps be considered superior on account of its doing away with a great deal of the harshness observable in many instantaneous pictures developed with the pyrogallic acid.

143. Many kinds of varnish have been recommended, all of which possess some merit. The writer prefers those made with chloroform : the rapidity with which they dry preventing the annoyance caused by the settlement of particles of dust on those which dry more slowly, and the ease with which they are applied making them also additionally valuable to the beginner.

144. Whatever varnish is used the plate must be perfectly dry before its application, and the drying must not in any case be attempted to be hastened by blowing upon it with the mouth, the moisture of the breath causing an opacity of the film not at all desirable. All the varnishes may be applied to the glass in the same manner as when coating it with collodion, and the above remarks may serve as a caution for all.

145. Mastic varnish (picture varnish) is most frequently at hand, and should be diluted for use with twice its quantity of turpentine.

146. Spirit varnish requires rather different management than do the others. Before its application the plate must be held before a fire until it is as hot as the hand can bear ; the varnish is then poured on and drained off again into the bottle, and the glass, particularly if thin, is again to be held before the fire for a few moments, to keep up the heat until the spirit has all evaporated ; for when the plate is allowed to cool before the spirit has left it, instead of a hard, bright, glossy surface, only a dull, rough one (similar to that produced by breathing on the chloroform varnish while soft) is obtained.

POSITIVE PICTURES ON GLASS.

147. In touching upon this branch of the subject the writer is

obliged, in some measure, to depart from the course he had intended to pursue, namely, that of giving, instead of a compilation of the numberless methods, both good and bad, that have been suggested, only the one he had been led by experience to adopt; it being his opinion that the beginner at all events will be most benefited by having his attention directed to one course, instead of being bewildered by half a dozen, even if that one should not be the best.

148. As a rule the bath for positives should be more acid than for negatives; it is not however necessary to alter a good bath or to make a new one if *many* positives are not wanted, the effect of an acid bath being easily produced by adding two or three drops of tincture of iodine to each ounce of collodion; by this means almost any collodion will be made to give tolerable positives; although not so good as when a weaker collodion is used, it having been found that for positives a two-grain iodizing solution acts much better than the usual four-grain solution; it is also better to use a rather thinner collodion. The exposure for positives is less than that required for negatives, and they can be obtained with an amount of light which, with any exposure, would be incapable of producing negatives.

149. The chief difference in the course to be pursued for obtaining positives and negatives lies, after exposing, in the development.

150. The method most nearly approaching that for negatives is that suggested in the early days of collodion by Mr. Horne, and is even now thought by many to be good. He merely adds to the ordinary pyrogallic developing solution a small quantity of nitric acid, a drop or even less to the ounce being sufficient; if the picture comes out greenish and wants depth and brilliancy too much acid has been added, if, on the contrary, it looks brown and dull more is required; it must however be remembered that the deposit always looks whiter when dry than when wet. On account of the necessity, in some cases, of using

very small quantities of nitric acid, it should be kept diluted, so that a portion equal to no more than a fiftieth part of a drop of the strong acid may, when required, be added.

151. It will, with most kinds of collodion, be necessary to add to the developing solution some nitrate of silver, in the same proportion as recommended for negatives.

152. They may be fixed in the same manner as negatives, but more care must be taken to wash away all the developing solution before immersing the plate in the hypo, otherwise the acid contained in it will decompose the hyposulphite, and cause a blackening of the deposit, which, although not very injurious to negatives, would entirely spoil a positive. The cyanide fixing solution, given on the following page, is at present preferred by most operators to the hyposulphite; it certainly gives a whiter picture, although, in the opinion of the writer, not so rich a one.

153. The brilliancy and finish lost by drying when positives are obtained, either by this or any other means, are always restored by varnishing.

154. Far more brilliant, although to many not such pleasing, positives can easily be obtained by the following method:—Collodion rather thinner than usual is employed, and the plate is excited with the usual bath, and after exposing, not more than half the time that would be required for a negative, the image is brought out by immersing it in a bath made as follows:—

Protosulphate of iron	40 grains.
Nitric acid	2 drops.
Acetic acid	30 minims.
Alcohol	20 minims.
Distilled water	1 ounce.

The iron is to be dissolved in half the water, and when a solution is obtained, the nitric and acetic acids are to be diluted by mixing with the remainder, and are to be added to the iron solution; the alcohol may then be added.

155. No injurious effect arises from this solution becoming thick, as it does after being used two or three times; it is better however to filter it occasionally, and when not in use to preserve it from the air in a stoppered bottle.

156. In this, as in most other cases where positives are worked for, they may be fixed in the same manner as negatives.

157. The following method of M. Martin is much praised by French operators, and by many who have tried it here. Instead of the usual bath, one composed as follows is employed :—

Nitrate of silver	40 grains.
Nitric acid	24 minims.
Distilled water	1 ounce.

158. After exposure the plate is developed by immersion in a bath of sulphate of iron, which, instead of M. Martin's formula, had, the writer thinks, better be the same as that recommended in the preceding paragraph. When sufficiently developed he washes it thoroughly with water, and then immerses in another bath composed of—

Nitrate of silver	12 grains.
Cyanide of potassium	77 grains.
Distilled water	7 ounces.

which will convert the negative picture into a positive of a whiter and better colour than when hyposulphite is used.

159. It will often, in developing positives, be found that if sufficient exposure has not been given the picture develops slowly. When this is the case, instead of the blacks being pure and strong, a formation of small spangles of metallic silver takes place, after a time, over the whole picture, and of course spoils it. On the contrary, when over-exposed, the developing fluid acts so rapidly on the parts that have received most light, that it has to be poured off before the half tones appear; in this case the blacks will be very strong and clear, but all definition will be lost in the lighter parts.

160. The development must not be carried nearly so far as

when bringing out negatives ; it should be stopped before the details are visible in the darker parts, on account of the colour of the deposit forming the picture approaching so nearly to that of the iodide already there, that until the unchanged portions are removed we cannot perceive all the detail in the shadows that may have been obtained.

161. Contrary to the fault of under-developing, so frequently committed when working for negatives, it is more frequently found that good positives are spoilt by going too far, and that if we had not been so anxious to see all, we should not have lost all, the effect of over-developing being to blend into one mass the light parts of the image to the extinction of most of the delicacy for which positives are prized. In concluding this branch of the subject, the writer would caution those following his directions that he does not by any means think himself qualified to say much on positives on glass, but little of his attention having been given to them. He is also aware that there are methods much more perfect than those with which he is acquainted, but on which as a professional photographer he finds great difficulty in procuring information, particularly on a subject of such increasing value to those who possess any secrets of their own ; and unfortunately there are few of sufficient liberality to make public all they know.

PRINTING OR TRANSFERRING TO PAPER.

162. As without some instructions for making use of them, the negatives, towards the production of which so much attention has been directed, would be of no value, the writer has to offer from the many formulæ that have been proposed a selection of those most likely to be generally useful ; he would at the same time wish it to be understood that, in preference to those capable of giving brilliant results, but at the expense of much time and labour, he has chosen those which from their simplicity are most likely to be serviceable to the beginner, leaving to the more

practised operator the task of working out the improvements he may think necessary.

163. There is a marked difference between papers manufactured in England and on the Continent, most of those made abroad having a large portion of starch in their composition, and from that circumstance affording black colours readily, while in the English papers the starch is generally replaced by gelatine, and the black colours can only be obtained with difficulty. In many papers there is also a large quantity of chloride, which affects materially the results to be obtained upon them. One description made by Nash contains so much, that with no other preparation than brushing over a fifty-grain ammonio-nitrate of silver solution, very beautiful proofs are to be obtained. There is also a foreign paper which contains a larger quantity, at all events sufficient to render an alteration in the strength of the solutions necessary.

164. The apparatus required need be neither complicated nor expensive, all that is actually necessary being comprised in the following list :—

165. A few pieces of stout plate-glass rather larger than the pictures they are to be used in in printing,—some plain, others having smooth black cloth evenly pasted over one of their surfaces.

166. Some drawing boards, on which to pin the paper when the solutions are applied by brushing.

167. Some flat dishes for applying the solutions, when floating is preferred to brushing.

168. Two or three brushes made expressly for photographic purposes.

169. Some dishes for washing the proofs after fixing them.

170. Bibulous paper.

171. When a sheet of paper has been rendered sensitive by either of the following means, it is to be laid, the prepared side up, on one of the covered glasses ; the collodion negative is to be carefully placed, the coated side downwards, upon it, and then upon

that one of the plain pieces of plate-glass, the weight of which will be sufficient to bring the negative into close contact with the paper. After having done this in a moderately dark room, remove it to where the light of the sun, or even diffused daylight, can have free access to it for a time, varying with the intensity of the negative and the light, until it is dark enough. It may safely be looked at, by first carefully taking off the upper glass, and then while one end of the negative is pressed firmly on to the paper to prevent it slipping, the other is lifted just high enough to allow the progress of the picture to be seen. If it is not dark enough, the glass must be lowered down, and it must be again exposed to light.

172. Some difficulty may be found at first in returning the glass to precisely the same place it before occupied on the paper; a little practice will, however, soon enable the operator to do it successfully; and as so much of the beauty of the proof depends upon its having the proper amount of light, he must frequently inspect its progress: he will therefore do well to master this piece of manipulation as soon as possible.

173. The proof should always remain in the light until it is considerably darker than it is desired to be when finished, to allow for the loss it always sustains in the hyposulphite bath, and it should be borne in mind that an under-printed picture cannot be improved, while one that is too dark can, by prolonging the action of the hyposulphite, be reduced to almost any extent.

174. There are several ways of applying the solution to the paper; those most generally practised being either by the brush, or by floating the paper on a quantity of the solution placed in a flat dish.

175. When only small quantities of paper are wanted, it will generally be most advisable to apply the solutions by brushing, it being the most economical method. It will also be found that if a quantity of a solution is prepared, it will by brushing yield uniform results so long as any remains, while if applied by floating,

a constant change goes on ; so that when a comparison is made between the first and last sheets prepared, it will scarcely be possible to believe that the same process has been followed.

176. The use of the brush has been much condemned ; not, as the writer believes, from its being really difficult or wrong, but from the unnecessary cautions which have accompanied directions which have been given for preparing sensitive paper by its means. The paper to be prepared should be pinned by its corners to a smooth drawing-board, having previously placed a piece of white blotting-paper somewhat larger beneath it to absorb any solution that may pass over the edge. The solution is then to be brushed freely over it, first in one direction and then in the other, crossing the strokes so as to ensure an equal coating, repeating the operation if any inequality is observed. Sufficient of the solution should be applied by brushing in the first direction, the subsequent crossing being for the purpose of rendering that equal. Very little practice will enable the operator to apply just so much that by crossing once or twice there shall be no patches unabsorbed. When free from running moisture, the paper is to be pinned up by a corner to dry.

177. It is not necessary to have the paper perfectly dry before applying the silver solution, more brilliant proofs being obtained by its being brushed on while slightly damp. After the silver solution is on, however, the quicker and more perfectly it is dried the better.

178. The operator must not be deterred by this caution from laying by a stock of salted or half-prepared paper, if so inclined, the difference being very slight ; still, as there is a difference, it is thought right to mention it.

179. For floating the paper, a much larger quantity of the solutions will be required. They must be poured into a flat dish to the depth of about a quarter of an inch, and then the paper, previously cut to the proper size, is to be floated, by first placing one end on the fluid, while the corners of the other end are held by the fingers, bringing the whole gradually down upon it, and

exercising sufficient pressure to prevent any air-bubbles from remaining. When the ends cease to curl up (generally after one or two minutes), it is to be slowly raised, and then pinned by a corner to the edge of a shelf or table; and to facilitate the draining, a small piece of bibulous paper is to be attached to the corner from which the liquid drops. It is to remain suspended until dry.

180. One of the best formulæ for use with the brush is the following:—

1st sol. Hydrochlorate of ammonia	5 grains.
Distilled water	1 ounce.
Iodide of potassium	$\frac{1}{2}$ grain.

This solution may be applied at any time, no harm resulting from the paper being kept.

181. 2nd sol.—A fifty-grain solution of ammonio-nitrate of silver, which may be made as follows:—Dissolve 50 grains of nitrate of silver in about three quarters of an ounce of distilled water, and when perfectly dissolved add, drop by drop, a solution of ammonia; this will at first cause it to become turbid, but by cautiously continuing the addition, it will again become clear. No more ammonia than is just sufficient to redissolve the precipitate should be added, and, to be certain that no ammonia is present, a few drops of a fresh fifty-grain solution of nitrate of silver are to be added, to render it again very slightly turbid. The whole should then be poured into a glass measure, and distilled water added to make up a measured ounce.

182. If there is any excess of ammonia, no care will enable one to obtain an even coating by brushing, the traces of the brush where last passed over coming out distinctly in printing. If, however, the correction is carried much too far, the print, although quite even, will be indifferent, and have an effect of colour in some cases very remarkable, the lighter parts of the picture coming out when finished of a greenish tone, while the shadows are brown. This is more generally the case when small

quantities of chloride are used ; with the proportion above given it is very seldom seen.

183. This solution is to be brushed on in the same manner and quantity as the first solution of hydrochlorate of ammonia ; and as soon as it is sufficiently dry to allow of its being hung up, it is either to be pinned to the edge of a shelf in a dark room, or, which is much better, thoroughly dried at a fire. The paper will not keep long after the application of the second solution ; for, even if secluded from light and air, it will in the course of two or three days discolour.

184. If with this formula French (starch) papers are used, the colour of the finished proofs will be of a black tone ; but with the English (gelatine) papers, the colour will be a rich brown.

185. The use of ammonio-nitrate of silver has been, without reason, much attacked of late, on account of the supposed want of permanency of proofs procured by its means. This the writer ventures to think is an error, most of the blame it has been visited with being due either to the small quantity of chloride formerly recommended to be used with it, to the use of old and acid baths of bary-sulphite, or, which is quite as frequent, the carelessness of operators themselves in washing out the solutions imperfectly ; and he thinks if a comparison is instituted between proofs obtained by the same operator by this and any other process, it will be found that the defective ones will be equally distributed among them, the balance being perhaps in favour of albumen ; not, however, from its giving really more permanent proofs, but that from the nature of its surface it repels moisture better than the others, and so is less open to injury.

186. Another good formula for use with the brush is the following :—

1st sol.	Chloride of ammonium . . .	8 grains.
	Iodide of potassium	$\frac{1}{2}$ grain.
	Distilled water	1 ounce.
2nd sol.	Nitrate of silver	80 grains.
	Distilled water	1 ounce.

N. B.—Paper prepared by this formula will keep much longer than by the last.

187. For floating, it is necessary to have a larger proportion of chloride than for brushing. The following answers well :

1st sol.	Chloride of ammonium . . .	20 grains.
	Iodide of potassium . . .	$\frac{1}{2}$ grain.
	Distilled water	1 ounce.
2nd sol.	Nitrate of silver	90 grains.
	Distilled water	1 ounce.

188. The same time should be allowed for floating, both on the chloride and on the silver, a longer time to either being equivalent to a larger dose. If the proofs when finished are too brown, a shorter time on the silver or a longer on the chloride will produce a blacker tint.

189. There remains now only to mention albumenized paper, which, as affording positives of high finish with but little experience, has met with much favour. One of the many formulæ for its application that have been recommended is the following :

190. Take any quantity of the whites of eggs, and add to it an equal bulk of distilled water, then to the mixture add hydrochlorate of ammonia in the proportion of 16 grains, and iodide of potassium in the proportion of half a grain to each measured ounce. The whole is then to be well beaten with a silver fork, or, what is much better, placed in a porcelain egg-beater and well shaken. By allowing it to remain at rest for twelve hours, all the fibrous portions will sink to the bottom, and the limpid upper portion can be decanted off for use. It may be applied by floating; not more than one minute, if the operator is practised from a quarter to half a minute; the shorter the time the better. The papers best suited for albumenizing are the thin French and German. English kinds have not answered in the writer's hands.

191 When dry, the paper should be ironed with a moderately-

hot iron, previously placing it between two sheets of clean, smooth paper, and should then be laid by in a dry place : it will keep for any length of time.

192. When required for use it may be made sensitive by floating it for two or three minutes on the following solution :—

Nitrate of silver . . .	50 grains.
Glacial acetic acid . . .	2 minims.
Distilled water . . .	1 ounce.

FIXING THE PROOFS.

193. To fix the proofs which may be obtained by either of the foregoing methods except the last, the following solution can be used.

Dissolve in a bottle—

Hyposulphite of soda . . .	1 ounce.
Filtered water . . .	5 ounces.

194. In another bottle dissolve 15 grains of nitrate of silver in half an ounce of distilled water ; and when dissolved pour it into the solution of hyposulphite ; shake the two together, and let the mixture stand twenty-four hours before using.

195. The proofs should be carefully immersed in this bath, and be allowed to remain not less than an hour. If, however, they should have been so much over-printed as to require reducing still more, they may remain a longer time. After removal from this bath, they should be immersed for about ten minutes in a fresh solution of hyposulphite of the same strength as that just recommended, but without the nitrate ; they may be then well washed in a dish of hot water five or six times, draining them well between each, and allowing them to remain in the two last a quarter of an hour or more ; they may then either be pinned up or hung over glass rods to dry, and should afterwards be smoothed with as hot an iron as can be used without scorching.

196. By the process of Le Gray, in which blackened chloride of silver is used in the proportion of seventy grains to each ounce of hyposulphite in solution, very beautiful proofs of a neutral tint can be easily obtained; but if we wish for the additional security afforded by washing with hot water, we must sacrifice much of this beauty and be content with dull brown colours.

197. For the albumenized paper (and if desired for all the others), the following fixing solution may be employed:—

Hyposulphite of soda . . . 1 ounce.
Distilled water 5 ounces.

198. When the hyposulphite is dissolved, add two grains of chloride of gold previously dissolved in half an ounce of water; this will probably cause a precipitation of a small quantity of sulphur, which will have to be removed by filtering through bibulous paper. When clear, the solution will be ready for use. The proofs must be watched, and should be removed when the desired colour is obtained. They will at first become brown, but will gradually get blacker and blacker until they attain a rich purple. The change with a new solution goes on rapidly, two or three hours sufficing for the black colours, but after a time as much as even twenty-four hours will be needed, still they *can* be reached by giving time so long as the hypo has any solvent power left.

199. The proofs must be well washed as before recommended, and if hot water is preferred it may with more safety be used.

200. Although breaking through the writer's intention of mentioning only those methods of easy application, he cannot pass over Le Gray's very beautiful process for obtaining purple and black colours; but at the same time he would caution those who attempt its practice that, although perfect in the hands of those who have had experience, it is of all photographic processes one of the most difficult to manage successfully.

201. Paper prepared with plain nitrate of silver is better for this purpose than the ammonio-nitrate. The prints should be exposed much longer than for the ordinary method of fixing, in

fact until the whitish parts are of a violet hue. After the proof has been so exposed, it is to be immersed in the following solution, taking care to move it about while in :—

Distilled water	2 ounces.
Chloride of gold	1 grain.
<i>Pure</i> hydrochloric acid . . .	10 minims.

202. The picture clears immediately after immersion, becoming altogether lighter. When nearly light enough, it is to be washed in several waters to remove the acid, and then immersed in a bath of hyposulphite of the strength of one ounce of the hyposulphite to six of water, in which it is to remain not less than half an hour; it is then to be washed and dried as usual.

203. Very good results are to be obtained by reversing the application of these solutions; that is to say, by first over-printing the proof, then fixing in the hyposulphite, and then, after washings, immersing in the acid bath of gold, and again washing. Perhaps the last is the most secure of all methods of fixing.

204. The process for printing enlarged copies from small negatives is so interesting, and of so much value, that a short notice respecting it may be of service, particularly as the writer is not aware of any method having been published by which good proofs can be obtained.

205. A hole rather larger than the size of the negative should be cut in the shutter of a darkened room, into which a sheet of waxed paper or ground glass is to be inserted, and if a slide is made to fit an ordinary camera of long focus, so as to receive the negatives and allow of light passing through them, we have all the apparatus necessary.

206. The negative fitted in the groove at the back of the camera must be brought within a few inches of the ground glass in the shutter, and, to prevent the diffusion of light in the room, a black cloth should be thrown over the space between the negative and the ground glass.

207. An ordinary double-portrait lens answers well, in fact, with

the exception of the slide for the negatives, the camera and lens remain as generally used, the image being thrown from the negative through the camera and lens on to a screen. With it portraits of any size may be obtained from the same negative, subject only to the range of the camera and the size and distance of the screen and paper.

208. Turner's "Patent Talbotype" paper is to be immersed, twelve sheets at a time, in a solution of iodide of potassium of the strength of three grains to the ounce of distilled water, and after half-an-hour's immersion is to be hung up to dry. It will keep for several months.

209. The following solution is required for exciting:—

Nitrate of silver	15 grains.
Acetic acid	15 minims.
Water	1 ounce.

210. Just before use, immerse completely in this solution one of the sheets of iodized paper, and allow it to remain ten minutes, then take it out, and without blotting lay it on a sheet of glass perfectly clean, and place it on the screen (which should have wooden buttons to secure it) and by placing a piece of yellow glass in front of the lens the image may be focussed upon it direct; when perfectly sharp and distinct, the removal of the yellow glass will allow the light to act.

211. The time of exposure of course depends upon the amount of light, but with a bright sun shining upon the ground glass, and with a good lens, ten minutes will generally suffice.

212. The image should be slightly visible before developing, to do which (to develop) remove the paper from the glass and immerse it in a saturated solution of gallic acid, adding for a twelve-inch picture, half-a-dram of the exciting solution. When sufficiently developed, immerse in common water and wash several times, of the strength of one ounce to four of water, until the yellow iodide is entirely removed, and wash again thoroughly

in several waters, allowing it to soak in the last two or three hours.

213. When dry it will be finished.

214. We have now, from the first preparation of the glass to the final fixing of the proof, gone, it is hoped with sufficient care, through what is called the Collodion process; and if, in his attempt, the writer should have succeeded at all in removing the obstacles which unavoidably accompany the study of an art involving chemical changes of great delicacy, he will have the satisfaction of thinking, that the time he has given to Photography has been better bestowed than if his own amusement or profit had been the sole result.

WEIGHTS AND MEASURES EMPLOYED.

215. In almost every instance the quantity of solid substances has been mentioned as so many grains, but where the ounce or dram is mentioned, the ounce of 480 grains and the dram of 60 grains are to be understood.

216. When fluids are mentioned the *measured* ounce is meant, and the ounce is divided into eight drams of sixty minims each.

SOLUTIONS REQUIRED FOR NEGATIVES.

217. Sensitive bath—

Nitrate of silver	40 grains.
Alcohol 60°	30 minims.
Distilled water	1 ounce.
Iodide of silver to saturation.	

These must not be mixed direct, but the directions given in the body of the work must be followed.

218. Developing solution—

Pyrogallic acid	1 grain.
Acetic acid	5 minims.
Alcohol	10 minims.
Distilled water	1 ounce.

219. Silver solution for developing—

Nitrate of silver	40 grains.
Distilled water	1 ounce.

220. Fixing solution—

Hyposulphate of soda	10 ounces,
Filtered water	20 ounces.

221. In the different formulæ given it is supposed that all the chemicals are *pure*, the acetic acid *glacial* (solid at 40°), the nitrate of silver crystallized, the alcohol free from all extraneous matters, and the water, except where otherwise mentioned, distilled.

222. Those who are desirous of making Collodion for themselves, or in fact of making any exact experiments, should learn the use of the specific gravity bottle, it being impossible without it to be sure that we can repeat any experiment successfully; very few chemical liquids being sold of known or uniform strength, although they may be pure in so far that they are free from anything but water, still upon the quantity of that may depend the success of an experiment which has occupied much time.

The specific gravity bottle is made of very thin glass, having a perforated stopper, and capable, when filled and the stopper inserted, of holding exactly 500 grains of distilled water at 60° Fah.

These bottles are sold with a counterpoise of the exact weight of the empty bottle, so that when it is filled with water and placed in one scale of the balance and the counterpoise in the other, 500 grains will be required to bring it into equilibrium. All that we have to do, therefore, with any liquid, the specific gravity of which we are desirous of ascertaining—such as ether, alcohol, or sulphuric acid—is to fill the bottle and insert the stopper, when any excess will come up through the hole and must be wiped off. When perfectly dry it is to be weighed, and whatever the weight may be required to balance it, such as for washed ether 360 grains, or sulphuric acid 920 grains, by mul-

tiplying by 2 we get the specific gravity as compared with water, or 1000; for instance, ether, sp.g. .720; sulphuric acid, sp.g. 1.840. In the case of these two liquids dilution would be detected in opposite ways, the ether would be heavier, the acid lighter.

223. In weighing solids it is a good precaution to cut two squares of writing-paper to put into the scales from the same piece of exactly the same size; this is easily accomplished by folding a piece and cutting them together from it with a pair of scissors. If this is done for everything we weigh, there is little fear that anything wrong will get into our solutions, as we can by procuring chemicals from respectable houses be almost sure of their purity, more so than of the strength of the fluids required.

224. Care should be taken that all measures are quite clean and dry, and that the bottoms are also clean.

225. The smallest trace of hyposulphite on the camera frames or in the developing solutions will cause the plates to be stained.

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3	{ 6 $\frac{1}{2}$ by 4 $\frac{3}{4}$ or 5 by 4 8 $\frac{1}{4}$ by 6 $\frac{1}{2}$ or 6 $\frac{1}{2}$ by 4 $\frac{1}{2}$	Suited for the No. 3 Portrait Lens.	4 4 0 6 6 0 6 0 6

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Adapted for both Collodion Portraits, and Talbotype or Wax Paper Views, made in best Spanish mahogany, with sliding front for view lens, and extra one for portrait do., ground focussing glass, two double dark frames for paper, and dark box with inner frames for Collodion plates.

No.	For Views.	For Portraits.	Price.
	Inches.	Inches.	
1	6 by 7	3½ by 4½	{ Suited for the No. 3 View and No. 1 Portrait Lenses } 4 10 0
2	7 by 8	4 by 5	{ Suited for the No. 4 View and No. 2 Portrait Lenses } 5 10 0
3	8 by 10	4¾ by 6½	{ Suited for the No. 5 View and No. 2 Portrait Lenses } 6 6 0
4	9 by 11	4¾ by 6½	{ Suited for the No. 6 View and No. 3 Portrait Lenses or the No. 3 Voigtlander Portrait Lens, with extra mount for Views } 7 17 6

PORTABLE FOLDING CAMERAS.

This is a very convenient form of Camera for the traveller or tourist, as it packs up into small compass, and is very light. It consists of a mahogany box, the sides of which fold inwards; is fitted with ground focussing glass, two improved dark slides for sensitive paper, and sliding front; the whole, with the Lens or Lenses, fitted into a deal box, with lock and hinges.

No.	For Views.	Price, with View Lens.	If with second opening and extra front for Por- trait Lens, dark box, with inner frames for Collo- dion plates.
	Inches.	£ s. d.	£ s. d.
1	4½ by 6½	4 4 0	5 10 0
2	6 by 8	6 6 0	7 17 6
3	8 by 10	9 9 0	11 11 0

IMPROVED SLIDING AND FOLDING CAMERAS,

Combining the advantages of the sliding adjustment with the portability of the folding form, admirably suited for both Portraits and Views. With two double dark frames for paper, dark box, with inner frames for Collodion plates, and double action sliding front.

No.	For Views.		For Portraits.		Price.		
	Inches.		Inches.		£	s.	d.
1	10	by	8½	6½	by	4¾	8 18 6
2	11	by	9	6½	by	4¾	10 10 0

The above Cameras, fitted with rack adjustment by which the focussing is facilitated, extra..... £1 10 0

This form is well adapted for the No. 3 Voigtländer Portrait Lens.

Wood box for the above Cameras, lined with green baize, iron handles, lock and key 0 15 0

Leather sling cases for do 30s. to 3 3 0

These will be found very convenient by the photographic tourist.

Sling case for Lens..... 0 12 6

STEREOSCOPIC SLIDING BACK,

Which can be added to any of the before-named Cameras. With this arrangement, only one Lens is required for taking pictures suited for the Stereoscope.

For the $\frac{1}{4}$ plate Cameras with 2 frames 1 1 0

„ $\frac{1}{2}$ do. „ 4 „ 2 2 0

„ whole do. „ 5 „ 2 12 6

Sliding board for above 12s. 6d. to 1 5 0

STANDS FOR THE SUPPORT OF CAMERAS,

These are always made of the tripod form, to ensure steadiness. They are generally required to be portable for travelling and carrying in the hand.

No. 1. This Stand is constructed substantially in birch, very steady, and is well adapted for the portrait room of the professor or amateur 1 1 0

No. 2. Knight's Universal Tripod Stand. This is a very convenient form for medium-sized Cameras, when used for either Portraits or Views. It can be elevated or depressed at pleasure; is provided with an iron ball-and-socket joint, and is very firm; the legs being movable, it can be used on uneven ground.....	2 12 6
No. 3. With jointed legs	3 3 0
No. 4. French-pattern Camera Stand, made in walnut wood, with open jointed legs, boxwood ball-and-socket joint	1 8 0
No. 5. Superior form of Camera Stand, with every adjustment, especially adapted for the portrait-room of the professional artist.....	3 13 0
No. 6. The above Stand, fitted with rack and screw adjustments, greatly facilitating the adjustment of the Camera	8 18 6

FOR VIEW CAMERAS.

In taking Views, Buildings, &c., the Camera should always be kept in a horizontal position; the ball-and-socket joint, elevating screw, and other adjustments are therefore not necessary.

No. 7. Portable Tripod Stand, with circular brass top and double legs, made in mahogany; suited for small Cameras	12s. to 1 5 0
No. 8. Portable View Camera Stand, consisting of a brass or wood triangle attached to the Camera by means of a screw. The legs are made in ash or hickory, light, but strong, and when detached fold together	1 5 6
No. 9. Best View Camera Stand, of superior make; the legs light, but strong; fold together when not in use. This Stand is remarkably firm, yet very portable	1l. 15s. 0d. to 2 2 0
No. 10. The same as above, but with jointed legs	2l. 12s. 6d. to 3 3 0

HEAD RESTS,

For keeping the head of the sitter steady, without which a perfect portrait cannot be obtained.

Simplest form, for attaching to a chair.....	£0 6 0
Improved and more complete form, having several adjustments, to attach to a chair	0 14 0
American pattern	1 1 0
Claudet's Improved Head Rest, with velvet seat, and universal adjustment for the head. This form possesses many advantages	2 5 0

Beard's Universal Head Rest, mounted on a heavy iron foot, with sliding telescopic adjusting tube. This rest, standing on the ground, is used independently of a chair, and can be used to fix the head when the subject is in a standing position	3	13	6
	d.	0	0
		0	0
		0	0
		0	0

PHOTOGRAPHIC PRESSURE OR REVERSING FRAMES,

For obtaining Positive Pictures from Paper or Glass Negatives.

ORDINARY PRESSURE FRAMES.

No.		Inches.	£	s.	d.
1	For Pictures, up to	7 by 5	0	5	0
2	" " "	8 by 6	0	7	6
3	" " "	10 by 8	0	11	0

SUPERIOR DITTO.

Made in oak or mahogany, French polished, and adapted for both Glass or Paper Negatives, with jointed backs, allowing the operator to observe the progress of the Picture, and so constructed that a uniform pressure is obtained, and the danger of breaking the Glass Negative avoided.

No.		Inches.	£	s.	d.
1	For Pictures, up to	8 by 6	0	17	6
2	" " "	10 by 8	1	1	0
3	" " "	11 by 9	1	3	0
4	" 11 "	12 by 10	1	5	0
5	" " "	15 by 12	2	0	0

Heinecker's form of Pressure Frame for Paper Negatives, up to 11 in. by 9 in. £1 1s.

PHOTOGRAPHIC PAPERS OF THE BEST ENGLISH AND FOREIGN MANUFACTURE.**ENGLISH PAPERS.**

Makers.		Size.	Per Ream.	Per Quire.
		Inches.	£	s.
Turner's	Negative	9½ by 15	2	5 0
"	Positive	9½ by 15	1	5 0
"	Negative	19 by 15	4	10 0
"	Positive	19 by 15	2	10 0
Whatman's	Negative and Positive..	19 by 15½	2	10 0
Nash's	Positive	19 by 15	2	0 0

BIBULOUS PAPER.

Free from Iron and other impurities:—

	Per Ream.	Per Quire.
Extra stout, glazed or unglazed.....	1 12 0	0 2 0
Papier Joseph	0 17 0	0 1 0

FOREIGN PAPERS.

Makers.		Size.	Per Ream.	Per Quire.
		Inches.	£ s. d.	£ s. d.
Canson Freres ..	Negative	17 by 22½	2 10 0	0 3 0
" ..	Positive	17 by 22½	3 0 0	0 4 0
La Croix	Negative	17 by 22	..	0 3 0
" ..	Positive	17 by 22	..	0 4 0
Saxony	Negative .....	..	..	0 7 0
" ..	Positive .....	..	..	0 7 6
Marion's	Negative	22½ by 17½	3 0 0	0 4 0
" ..	Positive .....	..	3 10 0	0 4 6

PREPARED NEGATIVE PAPERS.*

Messrs. KNIGHT & Co. having given considerable attention to the preparation of both Negative and Positive Papers, can strongly recommend the following as affording very satisfactory results:—

	Size.	Per Dozen.
	Inches.	£ s. d.
Talbotype or Iodized	9½ by 7½	0 5 0
" "	15 by 9½	0 10 0
" "	15 by 19	1 0 0
Plain Waxed	17 by 11¼	0 5 0
Waxed and Iodized	17 by 11¼	0 12 0
Sensitive Waxed Paper ready for the Camera, will keep 14 days	11 by 8½	0 9 0

PREPARED POSITIVE PAPERS.*

	Inches.	£ s. d.
Salted Paper, prepared with Chloride of Sodium, printing well with a 30-grain solution of Nitrate of Silver	17 by 11¼	0 2 3
Albumenized Paper (French make)	17 by 11¼	0 4 0
" " of superior quality, prepared with very great care, and producing fine tones	11½ by 8½	0 2 6
" "	17 by 11¼	0 5 0
" Portfolios for Preserving the Papers	11½ by 8½	0 2 6
	3s. 6d. to 7s. 6d.	

* Larger or smaller sizes charged in proportion, except where the paper is cut to waste.

GLASS PLATES FOR THE COLLODION AND
ALBUMENIZED GLASS PROCESSES.

(Best Patent Glass.)

Inches.	Per Doz.	Inches.	Per Doz.
s. d.		s. d.	
3½ by 2½	1 4	6½ by 4½	4 0
4 by 3	1 8	8½ by 6½	7 0
4½ by 3½	1 9	10 by 8	12 0
5 by 4	2 6	12 by 10	17 6
6 by 5	3 9		

BOXES FOR CONTAINING ONE DOZEN GLASS PLATES.

Inches.	s.	d.	Inches.	s.	d.	Inches.	s.	d.
3½ by 2¾	2	0	5 by 4	3	0	8½ by 6½	4	6
4 by 3	2	3	6 by 5	3	6	10 by 8	5	6
4½ by 3½	2	6	6½ by 4¾	3	9	12 by 10	7	0

GLASS PLATE HOLDERS.

Nailor's Plate Holder. This consists of a mahogany board, with sliding wedge for securing the glass plate firmly during the process of cleaning £0 5 0

The Pneumatic Plate Holder. By a simple contrivance the air is exhausted from the interior, and the plate held by the pressure of the atmosphere 0 1 0

Improved Lever Pneumatic Plate Holder. This is an excellent contrivance, and holds the plate very firm, at the same time it is readily detached from it 0 5 0

DIPPING TROUGHs of Gutta Percha for the Collodion Process, with Glass Dipper:

For Glass Plates, up to 4½-in. by 3½-in.	0	5	0
,, ,, 5-in. by 4-in.	0	5	6
,, ,, 6½-in. by 4½-in.	0	6	6
,, ,, 8½-in. by 6½-in.	0	10	0
,, ,, 10-in. by 8-in.	0	12	6
,, ,, 12-in. by 10-in.	0	15	6

Improved Travelling Gutta Percha Dipping Troughs. The cover being secured by means of screws, there is no occasion ever to remove the solution of Nitrate of Silver.

Size for Plates, up to 6½-in. by 4½-in.	0	14	0
,, ,, 8½-in. by 6½-in.	0	16	0

PORCELAIN Dipping Trough and Dipper:

For Plates, up to 4½-in. by 3½-in.	4s. 0d.	{ With Ground Air-tight Cover for the Convenience of travelling }	0	8	6
,, ,, 6½-in. by 4½-in.	5s. 6d.		0	9	6
,, ,, 8½-in. by 6½-in.	6s. 0d.		0	10	6

PORCELAIN EGGBEATER for the Preparation of Albumen. 1s. 3d. to 0 2 6

PORCELAIN FILTERING JUG 1s. to 0 2 6

SHALLOW PORCELAIN DISHES.

With flat bottoms, for containing the different solutions used in the preparation of the paper. Size, inside measure—

No. 1.	5½ in. by 3¾ in.	.....	0	1	0
2.	7 in. by 5 in.	.....	0	1	6
3.	9 in. by 6½ in.	.....	0	1	9
4.	10 in. by 9 in.	.....	0	2	0
5.	11 in. by 9 in.	.....	0	3	0
6.	11 in. by 14 in.	.....	0	4	6
7.	15 in. by 12 in.	.....	0	5	0

DEEPER:—

10 in. by 8 in.	0 3 0
10 in. by 9 in.	0 3 6
15 in. by 12 in.	0 10 0
22 in. by 18 in.	0 17 6

FLAT GLASS DISHES,

For preparing the Sensitive Paper:—

No. 1. 8 in. by 6 in.	£0 7 0
2. 8½ in. by 7½ in.	0 8 0
3. 10½ in. by 8 in.	0 10 6
4. 12 in. by 9 in.	0 17 6
5. 14 in. by 11 in.	1 5 0
6. 16 in. by 14 in.	2 2 0

PLATE GLASS DISHES, with firmly cemented sides, warranted to stand the Nitrate of Silver: these being perfectly flat, very much economise the solution.

No. 1. 9 in. by 7 in.	£0 12 6
2. 10½ in. by 8½ in.	0 15 0
3. 12 in. by 10 in.	0 17 6
4. 13 in. by 11 in.	1 2 0
5. 15 in. by 13 in.	1 10 0
6. 20 in. by 16 in.	2 0 0
7. 24 in. by 20 in.	2 12 6

Mahogany Boxes for the above, 5s. 6d. to 15s. each.

GUTTA PERCHA WASHING DISHES.

These are very convenient for the Tourist, as they nest together.

No. 1. 8½ in. by 6½ in.	£0 3 0
2. 9 in. by 7 in.	0 3 9
3. 9½ in. by 7½ in.	0 4 6
4. 11 in. by 9 in.	0 5 6
5. 11½ in. by 9½ in.	0 6 6
6. 13 in. by 11 in.	0 8 6
7. 15 in. by 12 in.	0 10 6

Gutta Percha Dishes of superior finish, with perfectly flat bottoms }

Nest of 4, from 11 in. by 9 in. to 12½ in. by 10½ in. } 1 5 0

SCALES AND WEIGHTS.

In oak box with brass pans and weights	£0 4 6
Ditto glass pans and grain weights	0 6 0
Mahogany box with best beam glass pans and grain weights	0 13 6
Mounted on brass pillar with best beam glass pans, weights, the whole packed in mahogany box	1l. 10s. to 2 12 6

GRADUATED GLASS MEASURES.

Minim or dram:—

1 oz.	0 1 0	8 oz.	0 2 3
2 oz.	0 1 3	10 oz.	0 2 6
4 oz.	0 1 9	20 oz.	0 4 6

GLASS FILTERING FUNNELS.

2 in. diameter	4d.	4 in. diameter	£0	0	8
2½ " "	5d.	5 "	0	0	10
3 " "	6d.	6 "	0	1	0

THE OSCILLATING DEVELOPING STAND.

This form will be found very convenient, as by its aid the developing fluid can be kept in constant motion, and the frequent staining of the picture prevented	£1	1	0
		6	6
		2	2

LEVELLING STANDS, with set screws for developing Glass Pictures,	3s.	6d.	to 0	10	0
			2		

Glass Tripod ditto	0	1	6
		6	6

ECONOMICAL STILL, with Refrigerator for the distillation of water:					
One gallon capacity	1	1	0		0
Two ditto	1	7	6		0

RESERVOIR for distilled water, consisting of a large glass bottle fitted with glass tap.					
					0
No. 1	0	10	0		0
2.	0	15	0		0

3.	1	1	0		0
		6	6		

STONE WARE BARREL with brass cock, for distilled water, half gallon capacity	0	6	0
		0	

STONE WARE FILTER with cock, one quart	0	10	0
		2	

CYLINDRICAL GLASS VESSEL, with ground top and exhausting syringe, for preparing Iodised Paper, according to Stewart's process.....	2	2	0
		3	

OIL LAMP, with yellow glass shade for preparing Sensitive Paper, &c.					
					0

METRONOME, an instrument for marking seconds and half-seconds,	17s.	6d.	to 1	5	0

Improved ditto, with dial and warning bell, marking time in half-seconds up to five minutes.....	1	15	0
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SAND CLOCKS for marking time up to three minutes.....	5s.	to 1	1	0
			0	

IMPROVED PORTABLE PHOTOGRAPHIC PRESS,
FOR PREPARING AND PRESERVING SENSITIVE PAPERS, FLAT-
TENING AND MOUNTING POSITIVES, &c., &c.,

DESIGNED AND MANUFACTURED ONLY BY

GEORGE KNIGHT AND SONS, FOSTER LANE, LONDON.

A method being required by which the different papers used in the Photographic Art could be rendered perfectly flat, and also preserved from contact with the air (when they may be kept in a sensitive state a much longer period), the usual form of Letter Copying Press has been hitherto employed, but its weight and costliness has prevented its general adoption, and altogether renders it unfit for the Photographic tourist. Messrs. KNIGHT & SONS have, therefore, constructed one of a different form, and which they trust will be found to possess the qualities required, viz. lightness and portability, combined with strength and sufficient power, together with perfect security to the paper placed in it, being provided with a lock and key. It is made almost entirely in wood.

Size of Boards, 18 by 12.....	£2 2 0
,, 12 by 10.....	1 15 0

BRUSHES MADE EXPRESSLY FOR PHOTOGRAPHIC PURPOSES.

Broad Camel's Hair Brushes—

1½ in.....	2s.	3d.	3 in.....	2	3 9
2 in.....	2s.	9d.	4 in.....	0	4 9
2½ in.....	3s.	6d.	5 in.....	0	6 6

Thick round ditto	0	1	0
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HORN TONGS for turning or removing the prepared Paper in and out of the solution	0	1	6
--	---	---	---

HOT WATER APPARATUS for drying the Pictures or developing them by heat	0	14	0
--	---	----	---

GLASS RODS, for spreading solutions	0	1	0
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Spencer's Improved ditto	0	1	0
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Vide "Photographic Journal."

Dr. Percy's Triangular Glass ditto	1s.	to	0	1	6
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PORTABLE TENTS,

For manipulating in the open air, especially suited for the Collodion process	£	8s.	to	4	4	0	0
Made waterproof.....				4	10	0	0
							0

FRAMES AND CASES FOR FINISHED PICTURES.

Morocco cases with gilt mats and glasses.

No.	Inches.	Good Quality.			With best Mats and Hinges, and fine colourless glass.			3
		£	s.	d.	£	s.	d.	
1	2½ by 2	0	10	6	0	18	0	6
2	3¼ by 2¾	0	16	6	1	6	0	2
3	4 by 3	1	2	0	1	14	0	0
4	4½ by 3½	1	4	0	1	17	0	6
5	5 by 4	2	2	0	2	16	0	6
6	6 by 5	3	0	0	3	17	0	6
7	6½ by 4¾	3	6	0	4	4	0	0
8	8½ by 6½	5	15	6	7	0	0	6

Professional parties may have their name and address put on the cases at a moderate extra charge.

Morocco frames with suspension ring, gilt mat and glass, one third less in price than the above.

SUPERIOR GILT MATS,

Either Square, Oval, or Dome.

No.	Outside Measure. Inches.	Second Quality.			First Quality.			3
		£	s.	d.	£	s.	d.	
1	2½ by 2	0	2	0	0	2	6	2
2	3¼ by 2¾	0	2	9	0	4	0	0
3	4 by 3	0	4	6	0	6	0	3
4	4½ by 3½	0	5	6	0	8	0	1
5	5 by 4	0	7	0	0	12	0	1
6	6 by 5	0	16	0	1	0	0	1
7	6½ by 4¾	0	14	0	0	18	0	1
8	8½ by 6½	1	7	0	1	12	0	1

SUPERIOR BLACK PAPIER MACHE FRAMES,

With Gilt Rim, Mat, and Suspension Ring.

1	.....	each	0	4	0
2	.....	"	0	5	6
3	.....	"	0	6	6
4	.....	"	0	7	6

ORMOLU FRAMES,

With Gilt Mat and Glass.

No.	Inches.	£ s. d.
1 For Plates	2½ by 2	0 1 9
2 , ,	3½ by 2½	0 2 9
3 , ,	4½ by 3½	0 4 0
4 , ,	5 by 4	0 7 6
5 , ,	6½ by 4½	0 10 6

PASSE PARTOUT FRAMES,

Ornamental and plain, dark ground, or white and gold, of every size, and great variety of pattern.

No.	For Pictures.	Per Dozen.	Per Dozen.		
			Inches.	From	To
1	2½ by 2	£0 5 0	2½	£0 18 0	
2	3½ by 2½	0 6 0	3½	1 1 0	
3	4 by 3	0 7 0	4	1 4 0	
4	4½ by 3½	0 10 6	4½	1 7 0	
5	5 by 4	0 12 0	5	1 10 0	
6	6 by 5	0 14 0	6	2 0 0	
7	6½ by 4½	0 14 0	6½	2 0 0	
8	8½ by 6½	1 7 0	8½	3 0 0	

GUTTA PERCHA OUTER FRAMES for the above:—

No.	£ s. d.
1	per dozen 0 12 0
.....	, 0 18 0
3	, 1 10 0
4	, 1 10 0

Passé partouts for large Talbotype pictures.

Show frames for four or more pictures.

STEREOSCOPES.

This beautiful Optical Instrument has given an increased value to the Photographic art: it was originally invented by Professor Wheatstone, but has lately been so altered, improved, and simplified by Sir David Brewster that it may almost be considered a new instrument. By its aid two dissimilar views of the same object are combined into one, but when seen so united the picture is no longer a flat representation of the subject, but has all the appearance of a real tangible solid, possessing length, breadth, and thickness. When these pictures are taken from life nothing can exceed the faithfulness of the representation, which must be seen to be appreciated.

Professor Wheatstone's Reflecting Stereoscope, for large Talbotype views.....	2l. 2s. to 4 0	0
Sir David Brewster's Lenticular Stereoscope, of the form as first made by M. Soleil, and exhibited by him at the Great Exhibition of 1851, with glass bottom, adapted either for opaque or transparent pictures.....	10s. to 17 6	0
In walnut, maple, or rose-wood, with ivory eye-pieces.....	10 0	3
In morocco leather	0 17 6	6
Knight's Improved Folding Stereoscope, in leather case, a very compact instrument, suitable for Daguerreotype or glass pictures.....	1 1 0	0
Kilburn's Registered Folding Stereoscope, forming in one the case for the Miniature and Binocular Instrument	0 10 6	6
Stereoscopes mounted in ivory or horn, as an eye glass, very convenient for Talbotype pictures.....	1 4 0	2
Folding ditto	1 1 0	6
Very simple Stereoscope.....	0 3 6	6

KNIGHT'S REGISTERED COSMORAMA STEREOSCOPE.

This is a modification of the beautiful and very popular Instrument of Sir David Brewster. The advantages which it affords are—the greater facility with which the double images are made to form one picture, less fatigue to the eyes of the observer, and the ready adjustment of focus to different sights; also, by employing lenses of greater focal length, larger pictures can be viewed stereoscopically.

The improvement consists in employing, in place of the small semi-lenses, one large lens, which is rendered stereoscopic by cutting an ordinary plano-convex in half, removing more or less of the opposite outer diameters, and then transposing the pieces, so that the original centre of the lens becomes the two sides, and the outer edges come together.

The lens is mounted in a superior manner to the usual form of Stereoscope. Reflected light, either from a window or lamp, is admirably directed on the opaque pictures and transmitted light through the transparent ones. By the addition of coloured cards placed behind these latter, very pleasing effects are produced.

Mounted as a Cosmorama, so as to show in a very superior manner both opaque and transparent Pictures.

For Pictures, 3½ by 2½.....	£2 10s. to	£3 0 0
" 3½ by 4.....	4 10 0	
" 6½ by 4½.....	5 10 0	

ALBUMENIZED PAPER, GLASS, AND DAGUERREOTYPE PICTURES FOR THE STEREOSCOPE.

Albumenized Paper Pictures, comprising Views in England, on the Continent, and other parts of the world.....	1s. 3d. to	1 6
Ditto, consisting of works of art, groups, and figures from life	1	6
Superior ditto, arranged with much artistic taste.....	2s. to	3 0

VIEWS taken in the Crystal Palace, comprising all the various statues, courts, and galleries in that splendid building	2s. to	3 0
TRANSPARENT pictures taken on glass by the Albumenized process, consisting of views in Paris and other Continental Cities; views in Rome, Switzerland, &c., &c.....	5s. to	8 0
WORKS of art, statues, groups, and figures from life, taken on 'silver plates, by the Daguerreotype process.....	5s. to	12 0

PHOTOGRAPHIC PICTURES.

Specimens showing the perfection obtained in the various branches of the art.
The specimens consist of Views taken both at home and abroad, single figures
and groups, and will be found of great value, both to the artist and amateur,
2s. 6d. to 21s. each.

PHOTOGRAPHIC COLOURS.

Prepared from the Original Receipt of M. MANSION.

These Colours, which are in a state of impalpable powder, are used dry; they adhere to the Albumenized paper in a similar manner as to the Daguerreotype plate: the effect when applied with a proper degree of artistic taste is very pleasing, the original photograph not being obliterated or hidden by the colour.

No. 1 Box, containing 12 Colours, in small bottles	0 17 6
No. 2 Box, containing 21 Colours, with gold and silver shell, brushes, &c.	1 15 0
No. 3 Box, containing the whole of the Colours, gold and silver shell, an extra quantity of brushes	2 2 0

The Colours may be had separately, at 1s. 3d. each bottle.

LIST OF COLOURS.

1. Carmine.	9. Ditto for Clouds.	17. Grey.
2. Scarlet.	10. Orange.	18. White.
3. Dark Flesh.	11. Lemon.	19. Ditto for Clouds.
4. Light ditto.	12. } Greens.	20. Ditto for Solarization.
5. Colour for Lips.	13. }	21. Black.
6. Dark Blue.	14. Dark ditto.	22. Claret.
7. Light ditto.	15. Plum.	23. } Browns.
8. Yellow for Draperies.	16. Lavender.	24. }

PURE CHEMICAL PREPARATIONS, ETC., REQUISITE
IN THE VARIOUS PROCESSES OF THE
PHOTOGRAPHIC ART.

ACIDS.

ACIDS.		per oz. 6d. to 0	8
Acetic Glacial for Collodion.....	.....	per oz.	6d. to 0
Crystallized, for Paper Processes .....	.....	per oz.	10d. 0
Arsenic .....	.....	per oz.	0 6
Boracic .....	.....	per oz.	0 6
Formic .....	.....	per oz.	0 6
Gallic .....	.....	per oz.	1 6
Pyro-Gallic (pure) White Crystals .....	.....	per drachm	1 6
" .....	.....	per oz.	10 0

		£	s.	d.
ACIDS, Nitric (pure)	per lb.	1	6	0
" Succinic	per oz.	0	2	0
Sulphuric (S. G. 1.845)	per lb.	1	6	0
" "	per oz.	0	2	0
AMBER IN CHLOROFORM.				
A Hard Transparent Varnish for Collodion Negatives ..	per oz.	0	1	3
AMMONIA, Concentrated	per lb.	0	1	6
" "	per oz.	0	0	2
Bromide	"	0	4	0
Chloride	"	0	0	6
Iodide	"	0	3	6
ARSENIC, Iodide	"	0	2	6
BAARIUM, Chloride	"	0	0	2
BROMINE, Pure	"	0	2	6
Chloride	"	0	2	6
CADMIUM				
Bromide	"	0	5	0
Iodide	"	0	4	6
CARBON				
Preparing Finishing Powder for Buffing	per bot.	0	1	0
CHARCOAL.				
Animal Pure, for filtering	per lb.	0	6	0
" "	per oz.	0	0	6
COLLODION, Plain	per lb.	0	11	0
" Iodized	per oz.	0	0	9
" "	per lb.	0	11	0
" Iodizing Solution	per oz.	0	0	9
" "	per lb.	0	11	0
" "	per oz.	0	0	9
COTTON, Fine Carded	per b.	0	3	0
COPPER, Sulphate				
" "	per oz.	0	6	8
ETHER, Sulphuric, for Collodion	per lb.	0	9	0
" "	per oz.	0	0	8
GLYCERINE, Pure	per oz.	0	0	6
GOLD, Chloride, unadulterated with Soda	per drachm	0	8	6
" "	"	15	0	3
" "	"	30	0	5
" Hyposulphite (Sel d'Or)	per bottle	0	3	9
IODINE, Commercial	per oz.	0	1	6
" Resublimed	"	0	2	0
" Bromide (Sol)	"	0	1	0
" Chloride	"	0	3	6
" Tincture, prepared for Wax Paper	"	0	0	6
IRON, Ammonia-citrate	"	0	0	6
" Bromide (Sol)	"	0	3	0
" Iodide	"	0	2	6
" Protosulphite, Pure	"	0	0	2

		£ s. d.
ISINGLASS	per oz.	9 2 0
KAOLIN	per lb.	0 0 6
LIME, Bromide	per bottle, 3s. and	0 5 0
MANNITE	per oz.	0 2 0
MERCURY, Distilled	per lb.	0 3 0
,, Bichloride	per oz.	0 0 6
,, Protonitrate	,,	0 1 0
,, Pernitrate	,,	0 1 0
MILK, Sugar of	per oz.	0 0 4
OIL OF LAVENDER	,,	0 1 3
,, Rosemary	,,	0 1 0
,, Turpentine	,,	0 0 6
POTASSA, Chlorate	,,	0 0 3
,, Chromate	,,	0 0 6
,, Bichromate	,,	0 0 6
,, Nitrate (Pure)	per lb.	0 2 0
POTASSIUM, Bromide	per oz.	0 3 0
,, Cyanide	,,	0 0 8
,, Do., pure Crystals	,,	0 2 6
,, Ferrocyanide	,,	0 0 3
,, Ferricyanide	,,	0 0 6
,, Fluoride	,,	0 1 0
,, Iodide	,,	0 2 6
,, Double Iodide for preparing Talbotype Paper	,,	0 2 6
ROUGE, finely prepared	,,	0 0 6
ROTTON STONE, finely prepared	,,	0 0 6
SILVER, Pure, Sheet and Wire	0 8 0	
,, Oxide, moist, for Solution	per bottle 3s. 6d. and	0 6 6
,, Acetate (Crystals)	per oz.	0 12 0
,, Chloride	,,	0 5 0
,, Cyanide, Solution	per pint	0 10 0
,, Aceto-nitrate	per oz.	0 1 0
,, Ammonio-nitrate	,,	0 1 0
,, Iodide	,,	0 10 0
,, Nitrate, Crystallized	,,	0 4 0
,, Solution, Prepared, for the Collodion Bath	per pint	0 10 0
SODA, Hyposulphite	per lb.	0 1 0
SODIUM, Chloride Pure	per oz.	0 0 2
,, Fluoride	,,	0 1 0
TONING, or Hypo Colouring Bath	in pint bottles	0 5 0
TRIPOLI	per lb.	0 6 0
,,	per oz.	0 0 6
VARNISH for Backing Pictures	in bottles, 6d. and	0 1 0
WAX, Prepared, for Negatives	per lb.	0 3 0

The above Prices are subject to variation.